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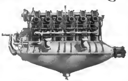

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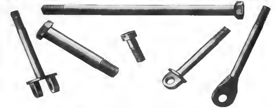

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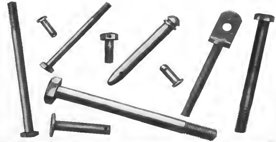

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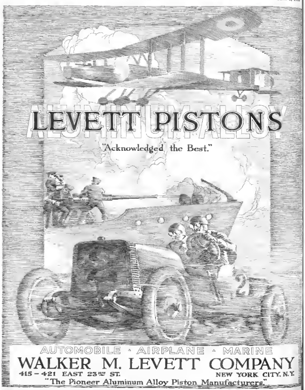

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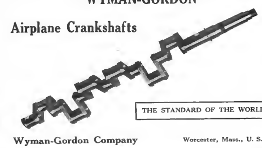

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Vol. IV June 1, 1918 No. 9

Air Propulsion*

By Morgan Brooks

Professor of Electrical Engineering, University of Illinois

This paper describes experiments with propellers, asserting that the accepted screw theory of air propulsion does not accord with the facts. Air is impelled by a propeller at a speed approaching twice the screw advance for small blade angles, hence the theory of reflection or batting action should replace the screw theory. Thrust is shown to be due in greater degree to velocity and less to blade disk area than is commonly supposed. A method of predicting the complete flying performance of a propeller from a single static test of an accurate model is indicated.

The term airscrew, considered by many writers on aeronautics as descriptive of propeller action, is a misnomer. The theory of the marine propeller, which seems to be adequately presented by the screw principle, has been transferred to air propulsion without sufficient regard for the extreme difference in the two fluids as to elasticity. Imagine automobile tires filled with water. In view of the current theory that air is driven by a propeller with a velocity never exceeding the product of the propeller's pitch and its revolution, it was a surprise to find that air may be driven backward at a velocity nearly twice as great as this product indicates. The fact was so revolutionary as to cause the greatest care in measurement before its acceptance. Recognition of this superspeed action of propellers explains many anomalies of air propulsion and will undoubtedly lead to more exact formulas for thrust and power calculations.

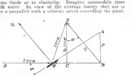


Fig. 1 Diagram Illustrating Test Conditions for a Wide-Blade Propeller Having a Blade Angle (α) of 36 Degrees

The purpose of this paper is to give proofs of the facts stated, and to point out some of the applications of the superspeed theory as it relates to propellers and blowers.

Superspeed is not observed readily in connection with the standard type of two-bladed propeller, owing to the masking of the effect by the mingling of high-speed air with a much larger quantity of inert air lying between the propeller blades. The measurements were made upon a special type of propeller having extremely short blades of great width, sweeping the entire 360 deg. of the disk area, in fact. It should, perhaps, be stated that with the acceptance of superspeed the definition of slip as "the backward velocity of the current from a propeller" must be abandoned, but another definition of slip, "the shortage of velocity of translation as percentage of propeller screw advance," may survive owing to its convenience.

A propeller of the wide blade type described having an experimental mean pitch of 2.53 ft., gives a wind on static test that flows 3.33 ft. per revolution, regardless of the rotation speed of the propeller. These values were determined for the writer by Prof. E. P. Lesley at the Leland Stanford Junior University wind tunnel, confirming his own measurements. The superspeed ratio, 3.33/2.53, is 1.32, and these figures bear so direct a trigonometrical relation to the blade angle as to suggest that air instead of being swept backward by screw pressure is driven back by precise reflection or batting action.

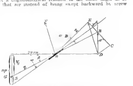


Fig. 2 Diagram Illustrating Test Conditions for a Propeller Operating on a Flying Plane or in a Wind Tunnel

The diagram, Fig. 1, illustrates nearly to scale the test conditions for the propeller mentioned above having a blade angle, α, of 36 deg. The blade element indicated at O is moving toward the left at the velocity indicated by the line $BO = 2\pi rn$, around an axis parallel to CE far below the plane of the paper, and strikes an air particle at point D. The relation of particle to blade is unchanged by assuming that the particle D moves to the right at same speed against a stationary blade, and is reflected to point E in unit time. Had the blade not been in the way the particle would have reached B, hence the blade has deflected the particle in the direction BE, represented also by the vector Ov_r with respect to the plane. Ov_r is perpendicular to the instantaneous position of the blade when striking the particle. Under the reflection theory assumed, the axial velocity of the air particle is the projection of this vector, that is, $CE = v_r \cos\alpha = 2\pi rn \sin 2\alpha$. To the same scale BA represents pitch multiplied by revolutions, the accepted air velocity by the screw theory. Since $BA = 2\pi rn \tan\alpha$, the ratio of superspeed velocity to screw-pitch velocity is $CE/BA = 2\sin\alpha\cos\alpha/\tan\alpha = 2\cos^2\alpha$. For the 36 deg. angle of the special test propeller this ratio, since $\cos 36° = 0.81$, is 1.31, which agrees with the value 1.32 experimentally determined by pitot tube measurement with sufficient precision to warrant acceptance of the reflection theory, especially when similar close agreement was found with a blade of 28 deg. angle and by other confirmatory tests.

* For presentation at the Spring Meeting, Worcester, Mass., June, 1918, of The American Society of Mechanical Engineers, 29 West 39th Street, New York.

To illustrate the more complex condition of a propeller operating on a flying plane or in a wind tunnel with corresponding wind conditions, Fig. 4 is offered. Here, as before, the blade instead of rotating to the left at the velocity $2\pi rn$, is assumed stationary, and the air particle at G is assumed to move to the right at the velocity $2\pi rn$ combined with the velocity V_a, also reversed, representing the plane's translational velocity, or, in the case of a wind tunnel, that of the impressed wind. In unit time the particle moves along the diagonal path Z, strikes the blade at O, and is reflected to E. The angle of incidence and of reflection is $\alpha - \beta$. But for the blade the particle would have reached B in the same time, so that the blade action is represented by BF, while under the screw theory the motion would be BA, the slip, which is more clearly

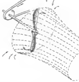


Fig. 3 Sketch Showing Direction of Air Flow from a Static Propeller

indicated as S at the left of the diagram. The axial projection of BE is $BE \cos \alpha$, not represented in the diagram, and the ratio $BE \cos \alpha / BA = 2 \cos^2 \alpha$, the same ratio as found for static test conditions. This relation is derived as follows:

$$BE = 2FE = 2Z \sin(\alpha - \beta) = 2Z(\sin \alpha \cos \beta - \cos \alpha \sin \beta)$$

but

$$Z \cos \beta = 2\pi rn = np \cos \alpha \sin \alpha$$

and

$$Z \sin \alpha = V_a$$

hence

$$BE = 2 \cos \alpha (np - V_a)$$

and

$$BF \cos \alpha = 2 \cos^2 \alpha (np - V_a)$$

Thus either for static or flying tests an air propeller produces a velocity or a change in velocity which has a super speed ratio of $2 \cos^2 \alpha$ as compared with the screw advance theory. This factor varies from nearly 2 for low pitch angles found near the blade tip to 1 for a 45-deg. angle, the steepest blade angle for effective work in propellers. For a propeller of constant pitch equal to diameter, a normal design, the superspeed ratio is 1.8 for the blade tip and 1.4 at half radius. Since the activity of propellers is confined mostly to the outer half of the blades, normal values for superspeed would be usually between 1.5 and 1.6.

In wind-tunnel tests, where alone velocities of the air can be measured satisfactorily, the propeller activity BF is combined vectorially with the wind velocity V_a, making the vector DE represented also by Oe, the velocity to be measured. The difference between this and $DA = np$ is not very marked, except at rather heavy slip conditions. For low blade angles, however, where the superspeed ratio is more pronounced, careful speed measurements show that the air leaves the propeller at higher velocities near the blade tips than part way in, a condition inconsistent with the screw theory for standard-type constant-pitch propellers. Eiffel's "Recherches" presents an elaborate collection of data showing this condition to exist, for which no explanation is offered, but the reflection theory explains it.

When the direction of the air flow from a static propeller is investigated by means of light ribbons, they show that the air moves in a direction strictly perpendicular to the blade angle, the condition demanded by the reflection theory but not by screw action. Moreover, these ribbons indicate that the stream contracts in diameter slightly as it leaves the propeller with its rotating whirl, whereas with the squeezing action of a screw it would be expected that the air would be expanding rather than contracting. Fig. 3 is an isometric drawing to show this rotating, contracting whirl.

The most convincing demonstration of the velocity of air leaving a propeller faster than the propeller screw advance is found in a test made with two propellers connected in tandem, illustrating a wind-tunnel test. Calling the forward propeller a blower, for distinction, assume that it provides a wind at 30 miles per hour, or 44 ft. per sec., and that the propeller is driven in this wind at a speed just above idling speed, such that its revolutions times pitch is, say, 48 ft. per sec. An anemometer shows a velocity of about 50 ft. per sec. If now the blower be shut down, while the speed of the propeller is maintained constant, the wind velocity rises to 75 ft. per sec. instead of remaining constant as demanded by the screw theory.

Accepting superspeed, then, it is seen that since the air is driven backward at an excess rate, the thrust due to this unexpected acceleration is, by the Newtonian laws of dynamics, due in greater degree to speed and less to the quantity of air handled than is commonly supposed. It has long been recognized that the evaluation of dynamic thrust equations requires the questionable assumption of blade activity over a larger portion of the propeller disk than that covered by the blades alone. Indeed some authorities, such as Riach, use the entire disk area as that actuated by the propeller. Seventy-mile flight at 30 per cent slip is commonly supposed to mean that the air is driven backward at 30 miles per hour, while its actual speed is nearer 50 miles per hour. This means that the column of air with respect to the plane is not 100 miles but about 120 miles per hour in length. No wonder it is difficult to get satisfactory results from air-dynamics formulæ now in use, except from well-developed empirical formulæ.

The proper interpretation of superspeed bids fair to reconcile the thrust and power values as derived from the static tests with those of wind tunnels or of flight, whereas it seems to be the common opinion today that flying performance cannot be predicted from static tests. With the precise air dynamics formulæ sure to come, a single static test of a propeller should furnish all necessary data for the production of complete flying-performance curves.

As a preliminary empirical approximation the following formula may prove useful: $T = T_n - T_n'$, where T is flying thrust, T_n the static thrust at propeller speed n, and T_n' the static thrust at propeller speed V/p, where V is plane velocity and p propeller pitch. That is, T_n' is taken statically at what is idling speed in the wind. Since all static-thrust values are proportional to the square of the rotations, a single static thrust at any speed enables both T and T_n' to be derived. The physical meaning of this seems to be that the wind-tunnel blower relieves the propeller of that portion of T_n represented by idling speed, even though the propeller, giving superspeed, sends air backward when tested statically at speed V/p, faster than velocity V. Under this formula the flying thrust at 30 per cent slip is found to be 51 per cent of the static thrust at speed n.

Current air-dynamics formulæ will not produce the changes in propeller design that might be anticipated, since propeller or air hat, is extraordinarily efficient today. However, it is hoped that this paper may lead to a clearer conception of the underlying physical principles of air propulsion.

[1] Efficiency Variation in Airscrews, Aviation, April 1, 1918.

Book Review

My Airman Over There. By His Wife. (Moffat, Yard & Co., New York. $1.35. 288 pp.)

This book is all in a class by itself among the countless literary productions resultant from the World War. The letters around which this book has been written by "His Wife" are those of a British fighting airman and disclose the tale of a romantic love story interspersed with gripping adventures of the air.

The latter are most thrillingly described and truly rank with that well known classic—"Cavalry of the Clouds," which is paying no mean compliment to the author of these letters.

The Friedrichshafen Bombing Biplane

This machine, which bears the marks F.D.H. G.3 326/17, was brought down by anti-aircraft fire at Isbergues on the night of February 16. A shell made a direct hit on the right-hand engine at a height of 8,000 to 9,000 feet, after which the machine covered about six miles and made a fairly good landing.

Various parts of the structure bear different dates, that on the tail being 14/1/18. The main spars are branded with a

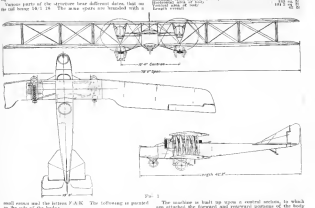


Fig. 1

small crown and the letters Z.A.K. The following is painted on the side of the body:

Leergewicht (weight empty), 2,695 kilogrammes = 5,929 lbs.

Nutzlast (useful load), 1,235 kilogrammes = 2,717 lbs.

Zulässiges Gesamtgewicht (permissible total weight), 3,930 kilogrammes = 8,646 lbs.

Crew—This machine carried its full complement of four persons, namely, pilot, fore-gunner, after-gunner and bomber. It is known, however, that the number of crew varies considerably, as some machines of this type have only carried two persons. The accommodation is so arranged that the personnel can easily change places, all the cockpits being intercommunicating.

General Description—The general design of the machine is shown in Fig. 1, which gives plan and front and side elevations.

The principal dimensions are as follows:

Span	78 ft.
Maximum chord	7 ft. 8 in.
Gap	7 ft.
Dihedral angle in the vertical plane	1½°
Dihedral angle in the horizontal plane	0°
Total area of main planes	934.4 sq. ft.
Area of upper main planes without flap	480 sq. ft.
Area of lower main planes without flap	454.4 sq. ft.
Load per square foot	9.24 lbs.
Weight per horsepower	16.6 lbs.
Area of flap of upper wing	21.6 sq. ft.
Balance area	1.8 sq. ft.
Area of flap on lower wing	18 sq. ft.
Balance area	1.38 sq. ft.
Total area of fixed tail planes	57.8 sq. ft.
Total area of elevators	32 sq. ft.
Balance area of one elevator	1.7 sq. ft.
Area of fin	20 sq. ft.
Area of rudder	18.2 sq. ft.
Balance area of rudder	3 sq. ft.
Maximum cross section of body	19.2 sq. ft.
Horizontal area of body	133 sq. ft.
Vertical area of body	131.2 sq. ft.
Length overall	42 ft.

The machine is built up upon a central section, to which are attached the forward and rearward portions of the body and the main planes. This central section comprises the main cell or cabin of the body, containing the tanks, bombs, etc. It also embraces the engines and the central portion of the upper and lower planes. The latter, together with the engine struts, are largely built up of steel tube, as is also the landing gear.

The central portion of the body, which measures 4 ft. across by 4 ft. 3 in. in height, consists of a box formation made of ply wood, strengthened by longerons and diagonals, and transversely stiffened by ply-wood bulkheads. The bulkhead furthest forward acts as an instrument board, behind which are side by side the seats of the pilot and his assistant. The former has a fixed upholstered seat, whilst that of the latter is folding, consisting of a light steel tubular framework with a webbing back-rest.

Underneath these two seats is the lower main gasoline tank. Behind this cockpit the body is roofed in with ply wood, the rear part of which roofing is detachable so as to give access to the second main gasoline tank, which is at the rear end of the main body section. By this means a small cabin or covered passage way is provided, at each side of which are the racks for the smaller bombs.

Central Portion of Wings—The central and non-detachable portion of the upper plane has a span of 19 ft. 5 in., whilst at each side of the nacelle the lower plane fixed portion measures 7 ft. 8 in. The main wing spars in this central portion are of

steel tube, roughly 2 in. in diameter, with a wall thickness of 1/16 in.

As shown in Fig 2, these spars are braced by steel tubes

Fig 2. Center Section of Lower Main Plane with Three-Ply Surfacing Removed

arranged in the form of an X, the manner in which the bracing tubes are attached to the main spars being shown in the sketch Fig 3.

The lugs are built up by welding, and are pinned and riveted in position, the joint being of the plain knuckle type

The upper surface of the lower plane is, so far as the central section is concerned, covered in with three-ply wood

In this portion the main ribs are of three-ply, with spruce flanges. Between each main rib is a cut-away rib, the design of which is shown in the sketch Fig 4. This, unlike the main ribs, is one piece of wood, and not built up For the greater part of its length it applies to the top surface only, being cut away to pass clear of the cross bracing tubes

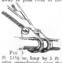


Fig 3

As shown in Fig 2 the plane is further stiffened with transverse members consisting of three-ply panels between each rib strengthened by grooved pieces top and bottom

The central section of the upper main plane is in one piece and is covered top and bottom with fabric In order to facilitate the removal of the engines, detachable panels measuring 1 ft 11½ in long by 1 ft 8 in deep are let into the trailing edge immediately over the engine bearers These panels are socketed in front, and at the rear are joined up at the trailing edge with U section sheet steel clips and bolts

The struts which connect the top of the nacelle to the upper plane are tubular and of streamline section, as are also the

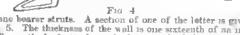


Fig 4

engine bearer struts. A section of one of the latter is given in Fig 5. The thickness of the wall is one sixteenth of an inch

The method of attaching the lower end of the engine struts to the tubular steel spars is shown in the sketch Fig 6, from which it will be seen that a welded Y socket is used and secured by a pin joint, the ends of the pin acting as anchorages for the attachment of the bracing wires.

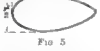


Fig 5

This sketch also shows the lugs which respectively support the detachable portion of the main planes and the vertical strut of the landing chassis The engine bearer struts are pushed into the Y socket and pinned in position, the pins being afterwards brazed into the socket At their upper ends the engine struts are fixed to the top plane spars with pin joints

Construction of Wings—The detachable portions of the wings are fixed to the center section by pin joints, one part of which is shown in Fig 6, the male portion being represented in Fig 9 The chord of the wing in the line of flight varies from approximately 7 ft 8 in to 7 ft 5 in, and the wing section is shown shaded in Fig 10 In order to provide a basis of comparison the R A F 14 wing section is superimposed and drawn to the same scale.

The main spars are placed one meter apart, the front spar

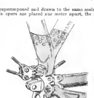


Fig. 6

being 272 mm in the rear of the leading edge. Both spars are of the built up box type, as shown in Figs 11 and 12. The former is the leading spar and the latter the rear spar These spars are of spruce, and each half is furnished with

Fig 7

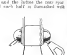


Fig 8

several splices so that the greatest single length of timber in them is not more than 14 ft. The splices, which occur in each half alternately, are of the plain bevel type about 15 in. long and wrapped with fabric A fabric wrapping is also applied at short intervals along the spar

Internal cross bracing between the main spars is afforded by steel tube cross members and cables attached as shown in the sketch Fig 9

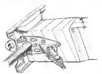


Fig. 9

The main spar joint consists of a steel plate 10 mm thick embedded in the spar end and held in position by five bolts,

Fig 10

which pass through a strapping plate surrounding the end of the spar This plate also carries the attachment for the bracing cable and is furnished with a spigot which locates the bracing tube It will be seen that at this point the spar is provided with tapered packing pieces of hard wood glued and held in position by fabric wrapping

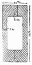


Fig 11

The main ribs are placed 360 mm apart Between them are auxiliary formers, consisting of strips of wood 20 mms $\times$ 10 mms. thick, which run from the leading edge to the rear spar The main ribs consist of ply wood webs socketed into grooved spruce flanges, which are tapered off, except where they are met by a longitudinal stringer The leading edge is solid wood moulded to a semi-circular section of approximately 65 mm diameter Where the rib web abuts against it, packing pieces are glued each side Between the main spars the web of the rib is divided by three vertical strips into four panels and in each of these it is perforated, leaving an edge all around about 72 mm wide

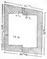


Fig 12

As shown in Fig 9, the upper flange of the main ribs is carried clear of the leading spar by means of packing pieces In the case of the rear spar, packing pieces are also used under the rib flange, as shown in Fig 13

The lower main planes for a width of about 2 ft. 3 in at their inner end are covered as to their top surfaces with three-ply wood

The interplane struts are attached to the main spars by joints of the type shown in Fig 14 This, it will be seen, follows the typical German practice of partially universal jointed mountings for the cable attachments. At the points of attachment of these strut joints, suitably tapered packing pieces of hard wood surround the spars, which at these points are also wrapped with fabric

Fig. 13

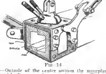


Fig 14

Struts—Outside of the center section the interplane struts are of wood built up, as shown in the section Fig 15, of five separate pieces. The curved portions are of timber which has not yet been identified, but is apparently of poor quality The cross web is of ash The strut is wrapped at frequent intervals with strips of fabric and is fitted with a socket joint of the type shown in Fig 18 The outer pair of struts are of smaller section than the main struts, but are built up in a similar manner Their section is 125 mm $\times$ 40 mm

Fig 15

Ailerons—The framework is principally of welded steel tube wrapped with fabric

A notable point is the thick section of the leading edge of the balanced portion, as shown in Fig 17

Fin and Fixed Tail-Planes—The framework of these is steel tube and in the case of the tail planes wooden stringers running fore and aft are arranged at intervals. The tail-planes are supported by diagonal steel tubes of streamline section, on the under side of which sharp steel points are welded to prevent these stays being used for lifting purposes

Elevators and Rudders—The framework in each case is of steel tube, the main tube being 35 mm. in diameter and the remainder 15 mm

Bracing—Throughout the wings, both internally and externally, the bracing is by means of multi-strand steel cable

Body (Rear Portion)—At the after-gunner's cockpit the section of the body has a rounded top, which is gradually smoothed down into flat The section, for the greater part of the length, is rectangular, and the frame is built up in the usual manner with square section longerons and verticals, the joints being arranged as shown in Fig 18 The cross bracing wires along the sides, top, bottom, and diagonal are of steel piano wire and are covered with strips of fabric, as shown in this sketch, where they lie adjacent to the fabric body covering

Fig 16

The vertical and horizontal compression members are located by spigots. The joint consists of a plate which completely surrounds the longerons, its two ends being riveted together to form a diagonal bracing strip For the last few feet at the tail the body is covered with thin three-ply

Fig 17

The body is covered with fabric, which is held in position by a lacing underneath and is consequently bodily removable

The floor of the after gunner's cockpit is elevated above the bottom of the body Immediately underneath this cockpit is a large trapdoor, which is hinged at its rearward end and furnished with two large celluloid windows. It is held in its "up" position by a long spring and a snap clip No means could be found by which it could be fixed in its closed position As footsteps are provided for all the cockpits, this trapdoor is evidently not intended for ingress and egress. It could be employed in connection with a machine gun firing backwards, as in the Gotha, but no machine gun mounting was fixed in this machine for this purpose

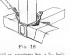


Fig 18

The rear portion of the body is attached to the center section of the body by a clip at each corner This is shown in Fig 19 The rear portion carries a male lug, which engages with the two eyes, and is held in position by a ⅜ bolt Four other bolts in tension pass through the sheet metal clip as shown in the sketch In each case the lugs are furnished with sheet steel extensions which, as shown in the sketch Fig 19, are sunk flush into the top and bottom surfaces of the body longerons and are there held with three bolts The corner joint is welded sheet steel and there is an additional diagonal sheet steel joint which serves the secondary purpose of providing an anchorage for the bracing wires.

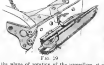


Fig 19

As this body joint is level with the plane of rotation of the propellers, it is armored both on the nacelle and on the rear portion of the body with a hinged covering of stout sheet steel lined with felt. A plate of armor a foot wide also extends down each side of the nacelle at this point.

(*To be continued*)

The Electric Dynamometer

By C. F. Scott

The extensive use of electric dynamometers for aviation motor testing prompts the presentation of these notes on the operation of dynamometers for the benefit of those who are called upon to operate them.

The operator finds the electric dynamometer so radically different in most respects from the propeller or club test which he may have seen elsewhere that he is at first apt to regard his task as difficult or complicated. A brief acquaintance with it however, shows it to be extremely simple.

The tester finds himself indoors instead of outdoors, comfortably warm in winter, absolutely safe, with no dangerous hand starting or "throwing-over," and with easy access to the engine. The equipment is easily handled by a man not previously trained in electrical matters. A good engine man has no difficulty with his electrical dynamometer. It is made as nearly fool-proof for him as possible.

On taking up the work of running an electric test-stand there are two matters which should receive the operator's attention. The first is the principle involved. The second is to see that the set-up and accessory lay-out are right.

The principle involved is best presented in a comparison with a propeller or club test. The propeller or club acts as a brake, restraining the speed of the engine. It can hold down a certain load, and no more (except as noted below) at a certain speed. To change that load the propeller or club would have to be made larger or smaller, that is, another size or pitch used. The exception to this fact comes when there is obstruction to the free flow of air from the club, as may be caused by walls or casings. This will change the load and throw off the calibration.

Furthermore, the club absorbs power at a rapidly increasing rate as the speed is raised. Thus, if a propeller produces a load of 80 hp. on the motor at 1400 r.p.m., it will only load the engine to about 35 hp. at 900 r.p.m. If the speed were raised above 1400 by 10 per cent to 1540 the load would be raised 20 to 30 per cent, more than the engine could pull.

Now, the electric dynamometer acts also as a brake, but the amount of load at a given speed is not fixed, but can be set by turning the field-rheostat handle (circular hand-wheel on the switchboard) to any desired amount. Bearing this in mind the operator will load the engine to the horsepower called for on his specifications, if on routine test, but will not attempt to put a continuous load at every speed which is as much as the engine will pull for a short time at that speed. Aviation motor carburetors are set generally for greatest efficiency at a given speed with full throttle and, if the motor is run at full throttle at a lower speed it will not be running under ideal conditions. On the other hand, in experimental work the operator can make a real power curve on the engine and make determinations and adjustments impossible to be made with a propeller or club with its fixed load.

The Way Power Is Measured

Another of the principles to remember is the way power is measured. With the cradle dynamometer power is the product of r.p.m. multiplied by the scale reading and divided by a constant. This constant will depend on the particular scales used. It is usually 3000 or 1000, that is, hp. = r.p.m. × scale reading in lbs. divided by 3000 on one type of scale, or by 1000 on another.

The operator will look carefully for any binding in the scale parts or any restraint in the free movement or oscillation of the dynamometer field on its trunnions. With these features correct, there are no variations in reading of power. The results are true. If the expected power is not indicated, it is not there.

This last requires the qualification that the power an electric dynamometer can absorb depends on the amount of electric current which can be forced through the external circuit. The external circuit is usually a bank of grids, in experimental work laid out to absorb a certain maximum and capable of adjustment. Lowering the resistance or shortening it increases the load. The test of this is to see if there is any more leeway in the field rheostat. If the hand wheel is turned all the way to the left, and the dial-switch all the way to the left, and all load switches in, and still the engine cannot be "pulled down," the remedy must be sought in "shortening the grids" or installing another bank, if the dynamometer itself hasn't reached its limit. If, on the other hand, the dynamometer is pumping back or returning current to the line, the amount of load which can be put on the dynamometer is dependent on the load on the line. In a big shop, using thousands of kilowatts of electric energy, there is no trouble about getting a load.

Now as to the second point, the accessory lay-out. First comes the matter of foundations. These cannot be too secure. There should be two feet of concrete under dynamometer and engine bases and the bases should be securely bolted or grouted to the foundations. They should be absolutely level. If the foundations are insecure disastrous vibration will result.

Next come the engine stands. These, too, must be secure. Rigid stands with wooden sub-timbers are considered best. Flexible stands have been used, but these must not be such as to increase any vibrations the engine may set up.

Third to consider is the coupling. This must be strong enough for the work and flexible. The coupling gets a good deal of strain, more than may appear at first to the observer.

Correct alignment of motor and dynamometer shafts is essential. Otherwise the bearings and crank-case may be subjected to strain and the coupling will heat up, cause a loss of power recorded and perhaps fail. The coupling should have considerable flywheel effect.

Water Circulation

Next comes the matter of water circulation for the engine. A fairly large tank is required, in order to maintain a sufficiently low temperature of intake. If the tank can be kept overflowing with cold water, so much the better. The circulation should be equivalent to that in the plane with the radiator exposed to a draft created by flight.

Then comes the oiling system. If the engine has a separate oil-cooling tank or radiator when installed in the plane, this should be duplicated in the test room. A long coiled pipe, either cooled by natural radiation or by immersion in water, should be provided for the external oil circulation. If the oil is cooled in flight simply by radiation from the pan or sump, the engine in test should have provided for it a draft of air to keep the pan cool.

Next comes the question of cooling the engine and carrying away the exhaust. With some types of engine it has been the practice on dynamometer testing to encase the engine and blow a stream of air over it by a motor-driven blower. This takes away the exhaust gases also, and incidentally a great part of the noise. With engines that are completely water-cooled, a blower for the exhaust gases alone is needed, if proper water and oil circulation is provided. This exhaust gas blower is conveniently made as a collapsible hood that can be drawn down to the top of the engine after the latter is set up. A small exhauster in the overhead discharge and an open motor driven fan near the engine to direct all air current into the hood should be supplied.

The effect of the wind set up by a propeller or club acts chiefly on the exhaust and does not cool the water and oil tanks after the manner of the wind set up by flight through the air. The wind on the propeller test stand is, so to speak, all on the outside of the circle.

Finally, there is the matter of electric current supply for exciting the dynamometer fields and for starting. This must be D. C. and it will usually be supplied at 220 to 240 volts. If the shop is using A. C. power generally, a rotary converter

Control Panel for 400 H.P. Electric Cradle Dynamometer

or motor generator set will be used to transform the power from A. C. to D. C. This must be at least large enough to provide all the power needed for starting the newest and stiffest engine. It is much more economical to have it big enough to handle the full power of as many dynamometers as may be running together under load at one time.

Actual Operation

Now we come to the actual operation. We will assume the equipment installed and set up ready for running, with all electric connections made and everything about the motor in readiness.

The accompanying photograph shows the standard control panel for a 400 hp. electric cradle dynamometer. The two meters shown have nothing to do with the measurement of power on this outfit. The voltmeter is used when the machine is "pumping back" to compare the voltage of the dynamometer with that of the electric supply line. The ammeter serves to show whether the current in the dynamometer is greater than that for which it was designed. The full load current in amperes is stamped on the nameplate of the dynamometer. A heavier current than this is an overload, even if the horsepower is lower than the rated horsepower, due to a weak field, which of course is simply a matter of rheostat adjustment. The dynamometer will stand a heavy overload for short periods, but when the overload exists, as indicated on the ammeter, the machine should be watched to prevent overheating.

The circuit breaker protects against too much overload. An auxiliary switch is provided on the circuit breaker to short the engine ignition if the breaker should go out.

There is a small double-throw switch on the panel which is used to reverse the dynamometer rotation, as would be required if right and left-hand engines both were to be tested.

Electric Dynamometer in Commission

Before starting it is a good plan to open this switch just a little to see if an arc is formed. If so, the field is excited. If not, there is no current on the field and the current supply must be looked into.

Now we are ready to go ahead. Open all the switches except the double throw field switch. Open the circuit breaker. Turn the circular hand wheel of the field rheostat around to the left as far as it will go. Turn the handle of the dial switch or controller up and to the left as far as it will go.

There are two operating conditions—first, loading on the resistance, second, loading back on the line. We will take up the first condition. Close the circuit breaker. Close the big 2-throw knife switch to the bottom. Push the "Start" button. The engine should at once turn over. As soon as the engine "fires," push the "Stop" button. Keep the throttle pretty well closed: the engine turning slowly.

Now, turn the field rheostat hand wheel sharply around to the right most of the way. Turn the controller or dial-switch handle way down to the right. Close all the knife switches to the top, including the switch that had been thrown to the bottom on starting. The load is now on.

The man at the throttle now opens up and the man at the dynamometer builds up the load by turning the field rheostat hand wheel slowly to left. The engine is loaded and the load can be brought to the desired value by simply turning the hand wheel. The load should be brought on gradually, watching the engine.

The dynamometer operator watches the tachometer, holding the speed to the desired value by manipulating the hand wheel. Let us assume a power reading is to be taken at 1200 r p m. The engine will be brought up to a speed a little above that and then pulled down to 1200 by turning the hand wheel gradually, allowing the engine speed to settle. When running smoothly at 1200, the scale reading is noted. When making a power curve, the speed is brought up in successive steps to a little above the values at which readings are to be made, and then brought back or settled to even values, 800, 900, 1000, etc., etc.

When making a long run at a given speed the operator should watch his scales closely. If the torque drops off, and the speed, and does not come back, the engine needs looking to. The close and accurate readings possible with electric dynamometers have saved many a new engine on its first test by giving a timely warning in this way.

If the test requires pulling the engine down to a very low speed, the dial switch or controller handle may be moved back to the left, to increase the low-speed load beyond what can be accomplished with the field rheostat hand wheel.

When loading a small engine on a 400 hp dynamometer, the two knife switches at the left of the panel can be left open.

The second condition, loading back on the line, involves the same operation in starting. But in this case the dynamometer is left connected to the line circuit. Close the circuit breaker. Close the two throw knife switch down or to the bottom. Turn the hand wheel to the left and the dial switch handle to the left. Push the "Start" button. When the engine "fires," turn the dial-switch handle all the way down to the right. The dynamometer will then be pumping back. The speed will probably be 1200 to 1500 r p m, depending on what speed the engine should run for the period of the test. Under these conditions the amount of load on the engine will depend on the throttle setting entirely, the effect of turning the field rheostat hand wheel being simply to vary the speed.

A refinement of starting can be obtained by turning the hand wheel to the right part way before pushing the button, reducing thereby the starting power of the dynamometer to a point where the engine fails to turn. Then, by turning the hand wheel back, the engine can be "broken loose" very gradually.

Another refinement consists in leaving the slow-speed switch closed on starting. This is the righthand switch of the four shown in a row on the panel, just to the left of the dial switch. With this arrangement a maintained slow lapping-in speed may be had.

Both of these refinements require a good supply of starting current available.

The panels on some outfits are not identical with those shown in the cut, but the general principle is the same in all.

The S. E. 5A Pursuit Biplane

In the March issue of the German aviation magazine *Luftwaffe* the following description of the British S. E. 5A pursuit biplane was published, a translation of which is here reprinted by courtesy of *The Aeroplane*.

The airplane in question was built by Vickers, Ltd., and was numbered B.507, bearing further the initial A as well as a white circle. The propeller was marked S. E. 5A, which leads to the idea that the older model of this same airplane type with the 150 hp. Hispano engine of the non-geared-down model is called S. E. 5.

The biplane has a surface of 22.8 sq. m., and both planes, connected with but one pair of struts to each side, have a span of 8.15 m., and a chord of 1.52 m., the gap from the top of the body amounting to 0.45 m.

No arrow-shape is to be found on this machine. The V-shape of the equal-sized ends of the upper and lower planes mounted on the center section and respective body rudiments amounts to 1.71 deg.

The sight field of range is improved by cutting out the center section in the middle and the lower planes near the body.

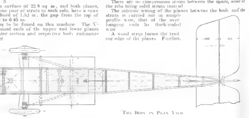
Above the angle of incidence is 5 deg. near, below, near the body 6 deg., near the struts 5 deg.

Both wing spars show sections of I shape, whereas the longerons of the rudiment piers, running through the body are steel tubes of 1.75 mm. thickness, and 45 mm. outer diameter. The plane ribs show the usual construction of most British airplanes.

There are no compression struts between the spars, some of the ribs being solid struts instead.

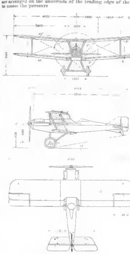
The interior wiring of the planes between the body and the struts is carried out in simple profile wire, that of the over hanging ends by thick-ended wire.

A wood strip forms the trailing edge of the planes. Further, two auxiliary ribs ranging from the trailing nose edge to the main spar are arranged between each two ribs.



The Body in Plan View

The fabric is sewed onto the ribs, and is painted yellow below, browned above, as is the fabric of the body. Shoe-eyes are arranged on the underside of the trailing edge of the plane to assess the pressure.



Front and Side Elevation and Plan

The center section struts are covered steel tubes. The plane spruce struts rest in long stampings, serving as fixing points of the vertical wiring.

Profile wire is employed for the plane cross wiring with twin wires for those carrying load and single for the counter ones.

The two spars of the upper planes are strengthened further between the center section and the struts with two wires each. Unbalanced ailerons are hinged to the back crossbar of the upper and lower planes.

The body shows the usual strut-cum-wire combination, being rounded above with semi-circular frames and fairings, and having three ply wood planking of 4 mm. thickness up to the pilot's seat. Body longitudinals and struts have sections of I shape, except the vertical struts behind the pilot's seat, which are worked out round.

The tail plane is a double curved aerofoil and is attached to the body so that the angle of incidence can be varied in flight within the limits + 4.5 deg. and — 3 deg. To this end the front spar is pivoted, while the rear spar, with its wiring, is fixed to a tube, arranged shiftable to the body stern posts. This tube rests with a piece of thread in a gear-nut, again resting in the stern post fixed, yet turnable.

When the nut is turned from the pilot's seat by means of wheel and cable, the tube is displaced upwards or downwards, transferring thereby the same manoeuvre on the rear spar of the tail-plane, and thus its angle of incidence changes.

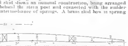
The elevator hooked to the fixed tail-plane partakes in this movement. The wires for operating the elevator are led through the body and tail-plane, which certainly saves air resistance, yet makes twice a 20 deg. direction change of each wire necessary. Main and tail planes are equipped with cellon

Front and Rear Wing Spar

windows, rendering inspection of the pulleys possible.

The under-carriage is of the usual V-type. The through-running axle rests between two auxiliary ones. There is no limit to the springing range.

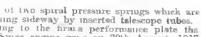
The tail skid shows an unusual construction, being arranged turnable behind the stern post and connected with the rudder cable by intermediance of springs. A brass skid bow is sprung



The Wing Section

by means of two spiral pressure springs which are prevented from turning sideway by inserted telescope tubes.

According to the firm's performance plate the Wolseley-Hispano Suiza engine gave on 30th August, 1917, on brake 206 hp. = 203 P.S. at 2005 revolutions. The r.p.m. of the four bladed airscrew is geared down in the ratio of 4 to 3. The diameter of the airscrew is 2.36 m.



The Tail-Plane

The exhaust gases are led behind the pilot's seat in two tubes on each side of the body. The motor affords easy access after removing the bonnet. The radiator forms the bow of the body.

A cover arrangement makes it possible to uncover the body about half way from the pilot's seat.

The main gasoline tank, of 120 liters capacity, is placed behind the engine on the upper body longitudinals. A gravity tank of 17 liters capacity is inserted in the center section between the leading edge and the main spar. The oil tank, of a capacity of 14 liters, lies cross in the engine frame below the rear edge of the motor.

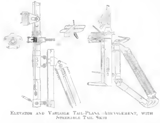
The fuel suffices for a flight of about two hours' duration.

Following instruments are arranged in the pilot's seat:—

To right: A box for the light pistols, a contact breaker for the self-starter, a contact breaker for the two magnetos, a triple led cock for the gravity and pressure petrol, a triple led cock for the hand and motor air pump, a thermometer for the

water of the radiator, the gasoline gauge placed on the back side of the main tank, and a manometer for air-pressure

To left: Gas lever, lever for regulation of the gas in



Elevator and Variable Tail-Plane Arrangement, with Steerable Tail Skid

altitude flights; lever for operating the radiator blinds, clip for three light cartridges. On the bottom is further arranged a hand pump for the hydraulic machine-gun gear, two boxes for drums for the movable machine-gun and the self starter. A square windshield of Triplex glass is placed in front of the pilot's seat.

The fixed Vickers' machine-gun is mounted to the left of the pilot inside the body fabric. The cartridge girdle is of metal. The firing of the machine-gun takes place hydraulically by means of a control arrangement, placed in front of the engine and connected with the machine-gun through a copper main, as well as driven from the airscrew by a gear set. The firing lever is fixed on the stick.

On the bow-shaped iron band lying on the center section rests a Lewis gun, which can be pulled down during the flight to permit vertical firing.

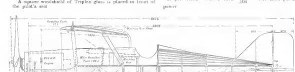
The weight of the machine, empty, was worked out at 700 kilos, distributed as follows:

	kg
Engine	229.0
Exhaust collector	12.0
Self-starter	7.6
Radiator	43.8
Radiator water	31.0
Airscrew	26.6
Main gasoline tank	17.8
Gravity gasoline tank	6.5
Oil tank	3.9
Engine equipment	6.4
Body with seat and plate covers	152.0
Tail plane incid. ncelange arrangement	1.9
Undercarriage	40.8
Tail skid	3.7
Pilotage arrangement	5.4
Planes with wiring	112.2
Vertical and horizontal wiring	20.0
Body equipment	14.0
	700.0

The fuel weight amounts with fully loaded tanks to 113 kilos., so that the total useful load can be calculated at 256 kilos., the total weight working thus out at 956 kilos.

The load of the planes is $\frac{956}{22.8} = 42$ kilos per square meter.

The performance load is then $\frac{956}{200} = 4.78$ kilos per horsepower.



Details of Body Construction in Side View

Aeronautical Patents

ISSUED APRIL 30, 1918

1,264,152—To Ernest G. Briggs, Brookville, Pa. Airplane.

1,264,330—To Wells M. Prutsman, Osborn, Ohio. Flying machine.

1,264,331—To Wells M. Prutsman, Osborn, and Albert D. Ray, Cleveland, Ohio. Flying machine.

1,264,484—To Thomas P. Brooke, Chicago, Ill., assignor to The Brooke Aircraft Co., a corporation of Delaware. Wing for airplanes.

1,264,438—To James C. Foley, Seattle, Wash., assignor to Boeing Airplane Co., Seattle, Wash., a corporation of Washington. Controlling device for airplanes.

1,264,712—To Howard P. Tweed, Denver, Colo., assignor to Benjamin F. Seymoure, Denver, Colo. Aerial apparatus.

1,264,732—To Peter K. Williams, Columbus, Ohio. Aerial top.

1,264,7[illegible]—To Andrew Allan, Leith, Scotland. Flying machine.

ISSUED APRIL 23, 1918

1,263,372—To Edward Richard Calthrop, London, England. Parachute.

1,263,757—To Rudolph R. Grant and Charles O. Morse, Norfolk, Va., assignors, by direct and mesne assignments, to Vernon M. Dorsey, trustee, Washington, D. C. Airplane.

1,263,758—To Rudolph R. Grant, Norfolk, Va. Landing and launching system for airplanes.

1,263,846—To Thomas P. Brooke, Chicago, Ill., assignor to The Brooke Aircraft Company, a corporation of Delaware. Flying boat.

1,264,037—To Rupert A. Emmons, Washington, D. C. Flying machine.

1,264,080—To Jacob Fuji, Fort Stanton, N. M. Parachute.

International Aircraft Standards Conference

By Coker F. Clarkson
General Manager of the Society of Automotive Engineers

The American Aircraft Commission, which spent several weeks in Europe recently in conference with engineering representatives of the Allies, on the formulation of harmonious specifications of materials and mounting and other dimensions of parts for aircraft, was constituted of three representatives from the Society of Automotive Engineers, three from the International Aircraft Standards Board, two from the United States Signal Corps, and one each from the National Advisory Committee for Aeronautics, the Bureau of Standards, the United States Navy, The American Society of Mechanical Engineers, and the American Society for Testing Materials. The request that the various societies appoint delegates having been acted upon, the whole matter was referred to the Government, and the personnel of the Commission decided upon after consultation with representatives of Governmental, manufacturing and organizing organizations.

The British Air Board (now the Air Council) had, in conjunction with the British Engineering Standards Committee (now the British Engineering Standards Association), formed a Sectional Committee to deal with the standardization of the components of aircraft and aircraft engines, and nominated several sub-committees to consider the details of the different branches of the subject. The British organization had been in communication with the French and Italian standardization committees.

The belief that the conferences just had would constitute a real advance, and facilitate ultimate international standardization, was borne out. The delegates had advisory powers only, the arrangement being that after conferring they would make recommendations to the authorities by whom they were appointed.

The members of the American Commission attended scores of sessions and conferences with their European brethren. Many aircraft and engine manufacturing plants were visited. Government factories, repair stations, laboratories and salvage depots were inspected and their methods studied. A formal International Conference was held in London, representatives of France, Italy, Great Britain and the United States being present. The general subject of cooperation of the Allied Powers, through exchange of ideas and standardization of aircraft materials, was discussed. All were in favor of a permanent aircraft standards organization representing at least five of the Allied Nations.

The following branches of the service and organizations of our Allies were represented in the conferences:

British.—Technical Department of Aircraft Production and Aeronautical Supplies of the Ministry of Munitions, the Admiralty, the National Physical Laboratory, the Aeronautical Society of Great Britain, the Society of British Aircraft Constructors, the Aircraft Steelmakers' Committee, the Technical Committee of Motor Industries, Aeronautical Inspection Directorate, Brass and Copper Tube Association, British Electrical and Allied Manufacturers' Association, British Ignition Apparatus Association, Cable Makers' Association, ball-bearing manufacturers, the Weldless Tube Association, the Irish Power Loom Manufacturers' Association, the Iron and Steel Institute, and the Steel Research committee.

French.—Section Technique de l'Aéronautique and Service de l'Aviation.

Italian.—Mission pour l'Aéronautique Militaire Italienne à l'Étranger, and Services d'Approvisionnement de l'Aviation Italienne.

The prime objects of the conferences were to facilitate the sending of most usable supplies to England, France and Italy from the United States and to settle mutually satisfactory standards and specifications, to make parts, fittings and instruments interchangeable on aircraft produced in the different countries.

England and France and Italy, during the past three years, have worked with an energy never before equalled, and have made tremendous strides in aircraft design and production. The members of the American Commission were highly encouraged by what they saw. The spirit of cooperation in which they were met, the wholehearted expression of desire to work jointly to achieve the largest result toward the one thing worth considering today, were most gratifying.

The production of our Allies is now large. The work of their technical and scientific men in aircraft lines has been carried on in a very extensive and effective way.

Specifications for Steels.—Progress was made at the conferences abroad in the formulation of Allied Standard specifications for aircraft steels, using the current American, British, French and Italian specifications as a basis, covering both the general procedure for testing and the chemical and physical requirements of wrought steels.

Fabrics.—The American standard fabrics have been submitted for test, and specifications have been recommended.

Dopes.—The British specifications and methods of inspection were studied carefully. The science and economics of the manufacture of these articles are, of course, important.

Radial Bearings.—In the metric sizes the S. A. E. and the British ball-bearing sizes are identical, except that six S. A. E. sizes have not been included in the British list. A revision of tolerances and limits recommended by the British and the American delegates is under consideration. Limits of eccentricity in radial bearings and outside dimensions of thrust bearings were other subjects of study.

Spark Plugs.—The 18-mm. spark plug, incorporating the best features of the British and the S. A. E. plugs, has been recommended for use on American and British stationary cylinder and rotary engines. Practically the same plugs are used in France and Italy.

Magnetos.—The dimension specifications for British and for American magnetos are substantially the same, with the exception of one dimension of magneto space. The American specification of the taper as one in five is the same as the British specification of the taper as one in ten, owing to the fact that the British refer to the slope of the conical surface to the axis.

Nomenclature.—Representatives of the National Advisory Committee for Aeronautics and of the Society of Automotive Engineers are conferring with the committee of the Aeronautical Society of Great Britain on nomenclature.

Instruments.—It is necessary to standardize further the connections and attachments and also the general character of the indication of instruments.

International Unification of Units of Measurements.—The plan, provisionally adopted by the sub-committee of the International Commission on Pipe Threads, which met in Paris, July, 1913, for a standard method of designating units of construction, was discussed, with reference particularly to screw threads and gear-wheel teeth, the idea being to seek a unit which could be used when either the inch or the metric system is employed. Taking screw threads as an illustration, a system of notation was outlined by which each screw would bear a distinctive number based on the diameter in eighths of an inch, and the pitch in the number of threads per inch or per 127 mm. (which equal five inches), without reference to the unit in which the measurement might be made. For example, a $\frac{5}{8}$-in. U. S. standard bolt having 10 threads per inch would be designated a "5 x 50" bolt in countries using the metric system. The selection of 127 mm as the length over which the number of threads should be stated in countries using the metric system is based on the fact that this gives whole number of turns, these being five times the number of threads per inch.

The very difficult problem of bringing together the advocates of the metric and of the inch bases is in abeyance, but it is felt by some that the plan outlined above may afford the first step.

Plywood and Cements.—The British specifications for plywood and for casein cement were discussed in detail.

Glue.—The practices in the preparation and use of glue are much the same in the United States and Great Britain. Mechanical methods of application and electrical methods of heating are used largely here, but neither of these methods is common in England. Comparative tests of British and American methods of testing glue are being made.

Timber.—The question of spruce supply was naturally discussed. Kiln procedure has been simplified, the results being satisfactory almost invariably. It is appreciated by all that the splicing of wood is an important subject. Additional

approved designs of laminated and box spars will be recommended.

Structural Tubing—The possibilities of further development in the methods of drawing and heat treating tubing are being studied, with promise of marked improvement.

Lubricating Oil and Gasoline—The gasoline and lubricating oil questions require continued attention, to assure adequate supplies of proper quality. Compounded oils will be furnished where required, as well as grades of gasoline of proper homogeneity and low end-point.

Propeller Hubs and Fittings—Propeller hub and fittings practice will be further unified so far as shall prove advisable and possible.

Water and Fuel Piping—Coordination of water and fuel piping standards is largely dependent on thread practice. The use of outside dimension only for nominal diameters of metal tubing has been recommended by the British and the American Committees.

Electrical Apparatus—The practice in electrical apparatus peculiar to aircraft, such as signal lights, radio, generators, batteries, heating and protective devices, is under consideration in view of more extensive use.

Wheels and Tires—The British and American practice in wheels and tires are substantially in accord. Discussion is being had as to the advisability of extending the list of wheel sizes which has been adopted here.

The number of tire sizes will be kept to the lowest possible minimum.

Steel Wire Cables—The British and the American steel wire cables are sufficiently alike to be practically interchangeable. The same thing is true of high-tension steel wire.

Turnbuckles—It is felt that similarity of design is not necessary in turnbuckles, satisfactory interchangeability being securable if the fork-end and pin dimensions are standardized.

Gasoline Rubber Tubing—Comparative tests are being made of gasoline rubber tubing made to British and to United States specifications.

Installation of Apparatus—Standardization will be effected so far as possible in the location, mounting, sizes, and calibration of direction and method of operation of instruments and apparatus.

The Work in Hand—The single aim in considering the various matters is to ascertain to what extent we can, without interfering with our production capacity, adopt European standards with advantage, to what extent we can assist more effectively in cases of European conformity with our practices, following the course that will bring the best results. That which does not contribute to the winning of the war is of quite secondary importance. Anything that does contribute to the winning of the war is obviously of prime importance.

As was pointed out by Winston Churchill, British Minister of Munitions, at the Inter-Allied Aircraft Conference, the detailed standardization of aircraft materials among the Allied Powers now fighting the Germans is based on principles so obvious that they really do not require emphasis, the principle of a common front of the troops, possible communication, a lateral communication between all parts of the front, of common reserves, upon which all can draw at any moment, of interchangeability of troops and of materials of all kinds at any moment—these are clearly steps which enable us, although we consist of many nations, fighting for a common cause to realize day by day and week by week the continuous approach toward complete unity of action and all the efficiency and integrity of action which come from a single purpose and a single system.

Aliens in American Factories

Industry faces a difficult problem in the unfriendly employe, which, according to the Man-Power Engineering Service of the National Americanization Committee, can be solved by the following method:

First of all take a census of all employes and divide them into four classes: native born, naturalized citizens, friendly aliens, alien enemies. If they are naturalized citizens of enemy alien descent they had better be classed industrially with alien enemies until something of their history and record is known. A man born on another soil has to prove himself for America. A certificate of naturalization granted under our inadequate requirements, where often a job is the goal, is not enough to class him with a native American.

Second—Make an analysis or a map of your plant, showing its vulnerable spots. Where will a fire do the greatest damage, where is waste accumulated, what hydrant is most vital in extinguishing a fire, where is the center of your lighting system, where will an explosion cause the most damage, what machines are most vital or difficult to replace, where can goods in transit be tampered with easiest? A dozen other questions will suggest themselves.

Find out what kind of workmen are in charge of these vulnerable points. If they are enemy aliens, transfer them at once. Don't wait to have them prove their loyalty. Some other point in the factory will not decrease their efficiency and it may increase safety. The fire-brigade and the man who can reach the hydrant the quickest ought to be loyal American workmen—just as men in the boiler-room and at delicate machines should also be. What do you know about these men?

Surveillance and guards and sentinels are the next most important considerations. Their number and location should be determined by the numbers and location of alien enemies and persons of doubtful loyalty, and by the strategic points to be guarded. *Both systems are necessary*—one for men, the other for places. They check each other and insure safety. With only one method there will at various times be exposed points. One agent may be diverted but two or more are difficult to divert simultaneously.

When fences are put up and windows barred and guards established, do you consult the factory plan to see that every vulnerable part is included or do you follow the example of one concern in New England and leave the transformer out in a field, fifty feet outside of the fence, where an enemy with a tin can of powder could paralyze the plant? Safeguarding is a job of engineering—not a make-shift job that anyone can do. It would be interesting for each industrial leader to find out who handled this work in his own plant.

Lighting is an important essential. Every possible improvement should be made; vulnerable points should be especially well lighted. *Keep alien enemies and persons of doubtful loyalty in the light all of the time.*

Keep outsiders out. This is no time for outsiders or persons without official authority on business in our plants. Verify credentials of visitors. When they get in see that they go only to the place they are supposed to go. Don't send them alone. Escort them in, stay with them, and escort them out, or supply them with a "guide" who will do so.

One way to keep outsiders out is to reduce the labor turnover. Every time a new man is taken on who is not known, it increases the risk.

Ask every new employe if he has a registration card. If manufacturing war supplies try to get every alien enemy out—not by throwing him out, but by exchanging with some industry that is not manufacturing war supplies. A man discharged because he is an alien may go to another plant in bitterness of spirit and wreck it for no reason than to get even with his first employer.

Permits should be required by employes to go to different parts of the plant. A general tag is not sufficient.

Appoint some employe as an aliens captain in the plant and give him a committee if it is advisable. It will become his business to spot anti-American propaganda and sentiment, to make such plans and maps as have been suggested, to supervise registration, recommend transfers and command the guards and sentinels. Call him by any preferred name but give him the whole job of looking after the safety of the plant from the man-power end.

Take a personal interest in the alien. If it is necessary set up an information bureau to help him understand drafts and regulations and registration. If he wants to learn English and become a citizen, help him to do so. See that he gets American information on bulletin-boards, in pay envelopes and otherwise, to offset the anti-American material sent him or told him. (Over 140,000 sets of cut-e lessons in foreign languages have already been handled by industries through pay envelopes.)

The American Government cannot protect the plant that will not protect itself, and the invisible war being carried on in American industries must be won by American manufacturers or the visible war in Europe will be lost.

Official Description of the Liberty Engine

The first official description of the Liberty aero-engine was issued on May 15 by the War Department, after many fanciful reports as to its characteristics had generally gained credence.

The official statement makes highly interesting reading on several accounts as one is able to judge that the Liberty engine does not embody any revolutionary feature in either method of construction or operation. This will tend to increase general confidence, for whatever failings this engine may still display, are a matter of detail which should not prove difficult to straighten out in the necessary process of "tuning up."

It is highly proper that official credit is at last given to the engineers who have been principally responsible for the design of the Liberty engine, for once the War Department has departed from its customary policy of secretiveness in telling the public about our military preparations. While one fully realizes the value of this policy in certain specific cases where information may prove of value to the enemy, no harm may be expected from the publishing of details of the Liberty engine, since it follows well known engineering standards, while on the other hand it will go a long way to quiet sundry rumor mongers and afford the technical man and thereby the public the conviction that nothing is fundamentally wrong with the Liberty engine.

The Official Description

Here is the statement prepared by the War Department:

The designs of the parts of the Liberty engine were based on the following:

Cylinders: The designers of the cylinders for the Liberty engine followed the practice used in the German Mercedes, English Rolls Royce, French Lorraine Dietrich, and Italian Isotta-Fraschini, before the war and during the war. The cylinders are made of steel inner shells surrounded by pressed steel water jackets, a method of applying which the Packard Motor Car Co., by long experiment, had developed. The valve cages are drop forgings welded into the cylinder head. The principal departure from European practice is in the location of the holding-down flange, which is several inches above the mouth of the cylinder, and the unique method of manufacture evolved by the Ford Co. The output is now approximately seventeen hundred cylinder forgings per day.

Cam Shaft and Valve Mechanism Above Cylinder Heads: The design is based on the Mercedes, but was improved for automatic lubrication without wasting oil, by the Packard Co.

Cam Shaft Drive: The cam shaft drive was copied almost entirely from the Hall-Scott motor, in fact, several of the gears used in the first sample engines were supplied by the Hall-Scott Motor Car Co. This type of drive is used in the Mercedes, Hispano Suiza and other engines.

Angle Between Cylinders: In the Liberty engine the included angle between the cylinders is 45 deg., in all other existing twelve-cylinder engines it is 60 deg. This feature is new with the Liberty engine, and was adopted for the purpose of bringing each row of cylinders nearer the vertical and closer together, so as to save width and head resistance. By the narrow angle greater strength is given to the crank case and vibration is reduced.

Electric Generator and Ignition: A Delco ignition system is used. It was especially designed for the Liberty engine to save weight and to meet the special conditions due to firing twelve cylinders with an included angle of 45 deg.

Pistons: The pistons of the Liberty engine are of Hall-Scott design.

Connecting Rods: Forked or straddle-type connecting rods, first used on the French DeDion car and on the Cadillac motor car in this country, are used.

Crank Shaft: Crank shaft design followed the standard twelve cylinder practice, except as to oiling. Crank case follows standard practice. The 45-deg. angle and the flange location on the cylinders made possible a very strong box section.

Lubrication: The first system of lubrication followed the German practice of using one pump to keep the crank case empty, delivering into an outside reservoir, and another pump to force oil under pressure to the main crank shaft bearings. This lubrication system also followed the German practice in allowing the overflow in the main bearings to travel out the face of the crank cheeks to a scupper which collected this excess for crank pin lubrication. This is very economical in the use of oil and is still the standard German practice.

The present system is similar to the first practice, except that the oil, while under pressure, is not only fed to main bearings but through holes inside of crank cheeks to crank pin, instead of feeding to these crank pins through scuppers. The difference between the two oiling systems consists of carrying oil for the crank pins through a hole inside the crank cheek instead of up the outside face of the crank cheek.

Propeller Hub: The Hall-Scott propeller-hub design was adapted to the power of the Liberty engine.

Water Pump: The Packard type of water pump was adapted to the Liberty engine.

Carburetor: A carburetor was developed by the Zenith Co. for the Liberty engine.

Bore and Stroke: The bore and stroke of the Liberty engine is 5x7 in., the same as in the Hall-Scott A-5, A-7, and twelve cylinder engines.

Remarks: The idea of developing Liberty engines of four, six, eight and twelve cylinders with the above characteristics was first thought of about May 25, 1917. The idea was developed in conference with representatives of the British and French Missions, May 28 to June 1, and was submitted in the form of sketches at a joint meeting of the Aircraft Board and the Joint Army and Navy Technical Board, June 4. The first sample was an eight-cylinder model, delivered to the Bureau of Standards, July 3, 1917. The eight-cylinder model, however, was never put into production, as advices from France indicated that demands for increased power would make the eight-cylinder obsolete before it could be produced.

Work was then concentrated on the twelve-cylinder engine and one of the experimental engines passed the fifty hour test Aug. 25, 1917.

After the preliminary drawings were made, engineers from the leading engine builders were brought to the Bureau of Standards, where they inspected the new designs and made suggestions, most of which were incorporated in the final design. At the same time, expert production men were making suggestions that would facilitate production.

The Liberty twelve-cylinder engine passed the fifty-hour test, showing, as the official report of Aug. 25, 1917, records "that the fundamental construction is such that very satisfactory service with a long life and high order of efficiency will be given by this power plant, and that the design has passed from the experimental stage into the field of proven engines."

An engine committee was organized informally, consisting of the engineers and production managers of the Packard, Ford, Cadillac, Lincoln, Marmon and Trego companies. This committee met at frequent intervals, and it is to this group of men that the final development of the Liberty engine is largely due.

In addition to the above facts, credit might properly be given to Mr. Hunt for the development of the water-jacket system for the Packard aero-engine, and to the Hall-Scott company for the crankshafts, since the dies for the four- and six-cylinder Hall-Scott engines were later reworked for the eight- and twelve-cylinder Liberty engines, respectively. It may also be added that the Hall-Scott company had completed four-, six-, eight- and twelve-interchangeable cylinder engines before the Liberty design was started.

While it is not generally known that four- and six-cylinder Liberty engines were designed the fact appears that they were not only designed but actually made.

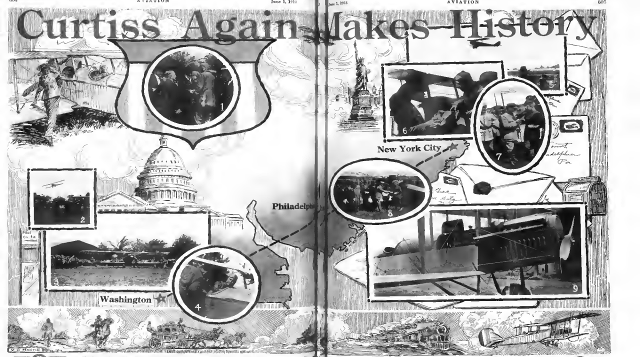
Signal Corps Air Section Needs 10,000 Mechanics

Call has been issued for ten thousand machinists, mechanics, chauffeurs and other skilled workmen needed at once by the aviation section of the Signal Corps, it was stated, and announcement was made that additional increments must be obtained from the same classes in the near future.

The degree to which the aviation program of the army depends upon highly skilled labor is shown by the statement that "ninety-eight of every hundred men in the aviation section must be skilled in some branch of work."

"Men registered in the draft," said the announcement "may be inducted into this service by applying to their local draft board. Men not registered may enlist at any recruiting office. Further information may be had by applying to the air division, personnel department, Washington, D. C.

Curtiss Again Makes History



The first regular aerial mail service between New York and Washington was started May 15th, 1918. Curtiss machines were used.

Lieutenant George L. Boyle left Washington in first Curtiss mailplane with Postmaster General Burleson's official opening letter. President Wilson cancelled and autographed aeromail stamp.

Lieutenant Howard P. Culver took Boyle cargo Philadelphia to New York in one hour, ten minutes. Mail, Lieutenant Torrey H. Webb carried from New York to Philadelphia reached capital in Lieutenant James C. Edgerton's plane three hours twenty minutes later. Flying time, Washington to New York, since reduced to two hours, 50 minutes.

Aerial postal service in U. S. first started by Postmaster-General Hitchcock in 1911, flying in Curtiss biplane Nassau to Mineola, L. I. In 1912 Mr Hitchcock licensed ten Curtiss flyers to carry mail; tests then made in New York, Georgia, Texas, Arkansas, North Carolina. Hugh Robinson, Curtiss pilot, delivered mail along Mississippi River from Minneapolis 375 miles.

1. The President and Mrs. Wilson, Postmaster-General [illegible], Cabinet members and other officials bidding [Lieut]enant Boyle good luck on the initial mail trip from [Washington] to New York.

[2. Fir]st plane piloted by Lieutenant Edgerton arrived [in Wash]ington at 1.10 p.m., flying 135 miles from Philadelphia [i]n one hour and 35 minutes.

[3. St]art of the first aerial mail service from Potomac [Park] again.

[4. Lieut]enant Edgerton arrives in Washington with the [mail] from Philadelphia.

[5. Lieu]tenant Webb leaving Belmont Park on the first trip of the New York-Washington Aerial Mail Route.

6. Lieutenant Culver handing his bag of mail over to New York Post Office officials after flight from Philadelphia to Belmont Park, New York.

7. Lieutenant Henri Farre, official aviation artiste of the French government, presents Lieutenant Webb with a good luck horse shoe just before the inaugurating flight.

8. Postmaster Patten of New York, Aero Club and City Officials wishing Lieutenant Webb Godspeed.

9. A close-up of one of the Curtiss machines made for Aerial Mail Service showing mail-carrying compartment.

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The 1917 Fokker Triplane

The following report has been issued by the British Air Ministry on the Fokker triplane, which was briefly described in the last issue of AVIATION. A fuller report may be issued in the near future, if further inquiry shows that the machine has features of interest. At present, however, the Fokker appears to be one of the poorest of modern German designs.

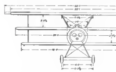


Fig. 1

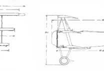


Fig. 2

General Description.—As regards outline design, the machine is somewhat similar to the Sopwith triplane and is in general of orthodox type.

The chief point which arises from a preliminary examination is the absence of external bracing wires. This point will be dealt with later.

Constructional Design.—It is from this standpoint, probably, that the machine is of greatest interest. The designer appears to have made every effort to reduce head resistance, even at the expense of increase in weight. In some respects, also, his efforts have tended to grave structural weakness.

Wing Structure.—The unique "twin" spar is shown in Fig. 3. It consists of two box-section tapering spars joined by transverse ply-wood. As far as can be gathered at present, the fore and aft shear strength of this built-up member is supplied by one port and one starboard bulkhead of ply wood in each plane. This appears quite inadequate, especially in a high-speed machine, even if we disregard the possibility of buckling of the laterally unstabilized ply-wood in nose-diving.

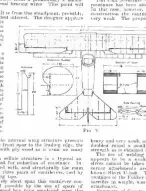


Fig. 3

Apart from this point, the internal wing structure presents no peculiarities. From the front spar to the leading edge, the upper surface is stiffened with ply wood as is usual on many modern scouts.

The nature of the main cellule structure is a typical example of the high price paid for reduction of resistance. Interplane wiring is dispensed with, and structurally the main frame may be regarded as three pairs of cantilevers, tied by pseudo-struts near the wing tips.

On a machine of relatively short span this cantilever construction may be rendered possible by the use of spars of great depth, and the ply wood box type employed meet this condition, owing to the abnormally high thickness-chord ratio of the aerofoil section. It is questionable whether the gain in overall efficiency by deletion of bracing wires is sufficient to balance the loss due to the use of a "high lift" section; this question naturally becomes more acute at high speeds, especially when the altitude is not approaching the ceiling; it is also rendered acute by the abnormally small gap-chord ratio employed.

The function of the interplane "struts" appears to be that of ties which partially distribute the load from plane to plane. Their section is such that they can hardly be expected to withstand reverse loading, and it is thought that this fact may be one explanation of the bad name which the Fokker has earned by breakage in the air.

Tail Unit Structure.—Here again we find that reduction of resistance has been attained by deletion of external bracing. In this case, however, the tail unit being largely of tubular construction the cantilever structure, besides being heavy, is very weak. The proportions of the framework are approximately such as obtain on most normally-braced frameworks, and once more an explanation suggests itself for the structural failures experienced on this type.

Body Structure.—The framework of the body is built up from steel tubing butt-welded at the joints. The standard wiring attachments consist of a short length of small tubing bent to the form of a quadrant or semi-circle (as required), and welded into the corners of cellules (see Fig. 5). The bracing wires are looped round these attachments, doubling back upon themselves, thus functioning as a single wire of double length. Splices are dispensed with, but beyond that nothing good can be seen in this method of wiring, which is heavy and very weak, as its "living strength" is that of a wire doubled round a small diameter pin in place of twice that strength as is obtained by splicing.

The use of welding in the building up of the body also appears to be a weak feature. Vibration and reversal of stress cannot be taken adequately by such a structure. The corner attachments are somewhat reminiscent of the well-known Short U-bolt. The U-bolt had the standardization advantages of the Fokker fitting, and, in addition, without further sacrifice in weight, was a far more reliable and robust wiring attachment.

Summary of Constructional Criticism.—On broad lines little good can be said of the Fokker structure. The designer appears to have employed considerable ingenuity (or exhibited considerable mental slackness) in devising schemes whereby slight increase of manufacturing speed has been purchased at the price of grave structural weakness or increased weight.

Where speed of production has not tempted him, his aim has been reduction of resistance. Here also, strength—and above all, permanence of structural rigidity—has been disregarded, and yet it is hard to see what notable gain of "fineness" has been attained.

Wing Tip Skids.—These are rigidly-fixed ash skids located

Fig. 4

under the wing struts. The reason for fitting them is obscure, as they can only come into play as a result of an appallingly poor landing, and if they did come into play, would certainly buckle the flimsy interplane struts.

Aerodynamical Features.—Certain of these features have been mentioned already. In this respect also, the design shows evidence that it has been carried out hastily and in a slovenly manner. There are signs of considerable ingenuity, but they are often marred by lack of broad consideration.

Wing Design.—Here, for instance, we have the elimination of external wiring. The "wireless" machine is not a new idea, many constructors have realized its good points—namely, the saving of wire resistance, and the diminution of tuning-up troubles. The Fokker designer has missed the counterbalancing defects, and his method of attack has led him into two grave faults. In the first place, the cantilever construction adopted is not only weak, but essentially non rigid. The deformation under maneuvering stresses and the consequent variations of aerodynamical load-distribution would appear to render the problem of controllability curiously complicated.

Further, the high cambered section of the aerofoils cannot but counteract the slight advantage due to the saving of wire resistance. Experience has shown that "low lift" aerofoils cannot be beaten for use on scouts, and that whatever advantage in climb and altitude flying capacity may be attained by the use of "high lift" sections is canceled and far more than canceled by the excessive horsepower required at fine angles of attack. When one considers the triplane effect (especially on small gap) which must, from first principles, obtain with such a deeply-cambered section the inefficiency of the main planes becomes evident.

Fig. 4 shows the amazing contrast between the Fokker section (full line) and R. A. F. 15 (dotted line) which may be taken as typical of British practice for similar machines.

Controls.—All control surfaces are balanced, but the method of balancing is inferior to that employed on the Albatros.

Ailerons are fitted to the top plane only—a type of construction which has been shown to be inefficient.

Engine.—The machine exhibited in the Aircraft View Rooms in London has no engine, but information received from over-

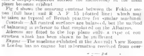


Fig. 5

seas states that the engine is an Oberursel, very similar to the 110 h.p. Le Rhône. In fact, it is understood the only differences are slight points of detail design and the relative poverty of general finish. For instance, the nose piece is in two portions, the propeller shaft being separate from and bolted to the front plate of the engine.

The carburetor is a French made Tampier bloctube, presumably obtained from a captured machine.

The oil pump appears to be a German copy of the standard Le Rhône oil pump. The magneto is a Bosch.

Armament.—Two Spandau guns are fitted, firing forward through the propeller, and fitted with synchronizing gear of the direct flexible drive type, a pinion on the flex shafting engaging with the gear wheel which meshes with the magneto and oil pump drives.

The guns are controlled by Bowden wires, from thumb-pushes on the control lever. Three pushes are fitted, two for firing the guns independently and the third for simultaneous control.

Identification Marks
R. F. C. No. G 125
Maker No. 1856
Military No. FOK. D.R.I. 144/17
Date of construction Nov. 20, 1917

Weights (as stenciled on Machine)

Weight empty	376 kg	=	829 lbs.
Permissible load (including fuel)	195 kg	=	430 lbs.
Total weight	571 kg	=	1 259 lbs.

Weight of Engine
334 lbs., including hub, magneto, oil pump and carburetor.
(Note.—Weight of 110 h.p. Le Rhône is 330 lbs.)

Tank Capacity
Petrol 16 gallons } approximate.
Oil 4 gallons }
Approximate duration—2½ hours at 10,000 ft.

From the above it is possible to construct the following approximate weight analysis:
Fuel, oil and tank 170 lbs. (allowing tank 18 lbs.)
Crew 180 lbs.
Military load 98 lbs.
Engine and propeller 358 lbs. (allowing propeller 24 lbs.)
Structure 453 lbs. (including engine bearers and instruments).
Structure percentage 36
Surface of main planes—205 sq. ft. (approximately)
Estimated B.H.P. (by analogy with 110 hp. Le Rhône)—113
lbs. per sq. foot—6.14
lbs. per B.H.P.—11.15

Flying Through Clouds

When flying in a cloud which obscures the horizon, says *Flight*, it is very difficult for a pilot to tell whether or not his machine is on an even keel. It is true that he will be able to tell from his speed indicator whether he is flying level or along a sloping path, but if at the same time the machine is making a turn this is difficult to "feel," as it may be very slight. The compass should, theoretically, indicate a turn, but what frequently happens is this: A machine enters a cloud and the pilot watches his compass and speed indicator to see if he is keeping on his course. He then notices that the compass needle begins to move, and rudders in the opposite direction to check the turn.

As he can see nothing except his machine, the horizon being invisible through the clouds, he is very apt to overcorrect, with the result that the machine begins to turn the other way. The rudder is then put over in the opposite direction, and very likely overcorrection again occurs. In this way the machine swerves from side to side, each turn being accompanied by a bank. If this bank becomes steep the machine will probably get her nose down and the speed indicator will register a high velocity. As the pilot may not be aware of the amount of bank, he will instinctively pull his control lever towards him in order to pull the machine out of the nose dive. If the machine is steeply banked the elevators will not "flatten out" the machine, since they are in a position somewhere near the vertical and therefore act as rudders. The compass continues to swing, and before long the pilot may not have the slightest idea of what is really happening to his machine, until he emerges from the cloud.

The French Aerial Operations in 1917

The following table, compiled by Jacques Mortane for *Aeronautics*, gives a detailed survey of the activity of the French Air Service in 1917.

	German Airplanes Brought Down				Bombing Raids (weight of bombs dropped lbs.)	
	In the French Lines	In the German Lines	Seriously Damaged	Kite Balloons	By Day	By Night
January	7	26	20		.	38,770
February	7	18	13	1	[illegible]	67,078
March	11	24	23		1,580	65,500
April	14	61	85	2	880	80,120
May	16	58	118	2	17,100	107,500
June	9	52	39	4	10,000	122,380
July	8	30	40	2	17,800	127,800
August	3	58	79	4	20,600	91,280
September	7	60	90	2	64,200	302,720
October	13	27	61	3	40,000	123,100
November	2	19	17		20,000	16,670
Dec. 1 to 15	16	21	28	1	41,300	45,300
Total	117	169	582	27	234,716	1,208,330

International Aircraft Standards

(Continued from previous issue)

2W 2—Mill Specifications for Aircraft Spruce

TIMBER.—1. The following species of spruce may be used in aircraft construction: Sitka spruce (*Picea sitkensis*), red spruce (*Picea rubens*), white spruce (*Picea canadensis*). The trees from which the logs are cut shall be in a healthy condition at the time of felling.

LOGS.—2. The logs from which the lumber is produced shall be freshly cut. No logs shall be used which have been allowed to stain or decay.

GRAIN.—3. The grain shall be straight; that is, the angle of deviation from a line parallel to the edges shall not exceed 1 in 30 (1:30) on surfaces with the diagonal grain and 1 in 20 (1:20) on surfaces with spiral grain. Stock 4 inches and thicker may be flat grain; stock less than 4 inches thick shall be vertical grain.

TEXTURE.—4. (a) The wood shall be strong, tough and elastic. Brashy pieces will not be accepted.

(b) The rate of growth of any piece shall not be less than 18 annual rings in each 3 inches (76.2 mm) (an average of 6 rings to the inch (25.4 mm)) when measured in a radial direction through the zone of maximum growth on either end section. Furthermore no single inch (25.4 mm) shall have less than 4 annual growth rings and not more than 10 per cent of the stock shall contain less than 8 rings per inch (25.4 mm).

KNOTS AND BURLS.—5. (a) At least 75 per cent of the total footage of each shipment shall be free from knots and from burly, curly, gnarly and irregular grain on all four sides of each piece.

(b) In the pieces comprising the balance of the shipment (25 per cent or less) knots and burls, or small irregularities of grain and other defects will be allowed provided that the buyer is able to obtain from each piece clear sound straight-grained cuttings over 10 feet (3.05 m) in length and not less than 4 inches (101.6 mm) wide by sawing out and discarding not more than 25 per cent of the total volume of the piece.

PITCH POCKETS.—6. (a) One pitch seam or pocket less than 2 inches (50.8 mm) long or its equivalent in minor pockets (provided they are not in the same annual ring) will be allowed on any face or on any two opposite faces of each piece 16 to 31 feet (4.88 to 9.45 m) long. Two pockets or their equivalent on any face or on any two opposite faces of each piece over 32 feet (9.75 m) long. Pieces shorter than 16 feet (4.88 m) and pieces narrower than 6 inches (152.4 mm) shall be free from pitch pockets.

(b) When the number and size of pitch pockets exceed the limits stated in paragraph 6 (a) the provisions of paragraph 5 (b) shall govern.

SAP.—7. Bright sap shall not constitute more than one-fourth the width of a piece nor more than one-third of its length.

ROT AND SHAKE.—8. All pieces shall be free from shake, rot, dote and all other forms of decay.

TOOL MARKS AND OTHER DEFECTS.—9. Pieces must be free from pieuroon holes, hook marks and other defects caused by handling tools and equipment.

WANE.—10. Wane will be allowed on occasional pieces, but in no case shall it exceed either one-fourth the thickness, one-eighth the width, or one-sixth the length of the piece.

DIMENSIONS.—11. Percentages of various thicknesses, widths and lengths and the respective percentages of flat and vertical grain stock to be supplied are subject to special arrangement between purchaser and contractor at the time prices are fixed.

TOLERANCES.—12. (a) Thicknesses may be scant, not to exceed one-eighth inch (3.18 mm) in occasional pieces. If more than one-eighth inch (3.18 mm) scant, they will be accepted at seller's option and tallied in the next inch class below.

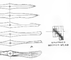
(b) Widths may be scant not to exceed one-fourth inch (6.35 mm) on occasional pieces. If scant more than one-fourth inch (6.35 mm) they will be accepted at seller's option and tallied in the next inch class below.

(c) Lengths may be scant not to exceed 2 inches (50.8 mm) on occasional pieces. If scant more than 2 inches (50.8 mm) they will be accepted at seller's option and tallied in the next 1 foot class below.

LOADING.—13. Shipment is to be loaded and covered in the manner prescribed by the purchaser.

2H 3.—Specifications for Mahogany Lumber for Use in Propeller Construction

GENERAL.—1. (a) The General Specifications, 1G1 shall form, according to their applicability, a part of these specifications.



PROPELLER MADE OF FIVE LAMINATIONS—SKETCH SHOWING SHAPE OF LAMINATIONS AND METHOD OF ASSEMBLING

(b) This specification is drawn to govern the quality of mahogany lumber supplied for the construction of propellers.

(c) Only true mahogany (*Swietenia mahogoni*) or such substitutes as are expressly approved may be supplied.[1]

GRADE.—2. (a) Each board supplied shall yield one or more laminations free from defects (see Fig 1), and the waste on each board shall not exceed one-third of the surface measure of the piece.

(b) Shipments on this specification must contain all lumber of better grade that has been produced in culling the logs at the mill. No portion of higher grade material shall be sorted out and retained by the mill.

GRAIN.—3. All boards shall be reasonably straight grained and suitable for propeller purposes. Quartersawed lumber is preferred.

TEXTURE.—4. Boards containing brashy dote, or punky wood will not be accepted.

DIMENSIONS.—5. (a) Unless otherwise specified in the order, dimensions shall be as follows:

(1) *Thickness.*—Rough green lumber must be full 1 in. thick.

(2) *Width.*—No board shall be less than 8 in. wide and not more than 10 per cent of the resulting laminations shall be less than 9 in. wide nor more than 25 per cent less than 10 in. wide.

(3) *Length.*—No board shall be less than 8 ft. long and at least 80 per cent of the resulting laminations must be 9 ft. long or over.

(b) The widths most desired are 10 to 14 in. with the greatest percentage between 12 and 14 in.

(c) Lengths and widths shall be measured according to National hardwood rules.[2]

SHIPMENT.—6. Rail shipments shall be made in closed cars, protected from the weather. The lumber must be carefully piled to avoid damage in transit.

INSPECTION.—7. (a) The inspector shall have free access to all parts of the mills where this lumber is being manufactured, and shall be afforded every facility to satisfy himself that the lumber conforms to this specification.

(b) This specification shall be subject to construction and interpretation by the inspection department of the purchaser.

REFERENCES: United States Signal Corps Specifications No. 15028 A.

[1] African mahogany (*Khaya senegalensis mahogoni*) is approved by the United States Signal Corps.

[2] National Hardwood Lumber Association rules, August 1917, page 10: Measurement. In the measurement of lumber of random widths, fractions of over one-half foot, as shown on the board rule, must be counted up to the next higher figure; fractions of exactly one-half foot and less as shown on the board rule must be counted back to the next lower figure. Tapering lumber in standard lengths must be measured one-third the length of the piece from the narrow end.

Problems in Propeller Design

The National Advisory Committee for Aeronautics desires to invite the attention of all designing engineers and particularly those interested in propeller design to two very important problems now confronting the air services of the nation, namely, a steel air propeller and a variable pitch air propeller.

The Special Sub-committee on Engineering Problems has reported that these problems have been under consideration for some time but so far without attaining satisfactory results.

These problems require careful mathematical study by technicians fully equipped with a sound understanding of the fundamental principles of aeronautical and structural engineering.

The ideal variable pitch propeller should embody means for changing simultaneously the diameter, area, and pitch for changes in air density. It is not necessary at design of the steel propeller follow the present practice in wooden air propellers but after careful consideration has been given to the aerodynamical principles involved, design and experimental work should follow fundamental structural engineering practice. The development of such propeller should be coincident with the development of the variable pitch propeller.

Aeronautical engineers and other technicians are invited to give thought to this problem and submit brief descriptions of their ideas with such drawings, data, and photographs as are necessary, to the National Advisory Committee for Aeronautics, Munsey Building, Washington, D. C.

Digest of the Foreign Aeronautical Press

Flight (London), April 18, 1918

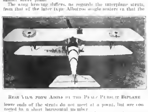
The Pfalz Pursuit Biplane—Among the more recent German pursuit machines there is one which up to the present has been little known to the general public, although it is employed to a considerable extent by the enemy.

This machine, the Pfalz single-seater biplane, is chiefly

SIDE VIEW OF THE PFALZ PURSUIT BIPLANE

remarkable on account of the fact that it imitates, as do the recent Albatros pursuit machines, the wing bracing originated by the Nieuport firm, incorporating a larger top plane and a smaller lower plane.

The wing bracing differs, as regards the interplane struts, from that of the later type Albatros single seaters in that the



REAR VIEW FROM ABOVE OF THE PFALZ PURSUIT BIPLANE

lower ends of the struts do not meet at a point, but are connected by a short horizontal member.

The lower plane has two spars according to usual practice although they are placed rather close together, thus forming in reality a compromise between the single spar lower plane of small chord on the ordinary two-spar lower plane with chord equal to that of the upper plane. The latter is in one piece and is mounted on four struts sloping outward from the body.

An interesting feature of this machine is that the lower planes are attached to a short wing root which is built integrally with the body.

The body is of elliptical cross-section and is built up of two thicknesses of three-ply wood which are fixed to the body frame in the form of long, narrow strips crossing one another at right angles.

The tail plane also presents an interesting feature in that it has a flat top surface and a convex bottom surface, its setting being a zero angle of incidence. This peculiar shape of aerofoil would obviously introduce in a steep dive a depressive force on the tail, and thereby tend to automatically flatten out the machine.

The engine is a 160 hp. Mercedes, which, except for the top of the cylinders, is enclosed in a streamline cowling, and actuates a tractor screw.

Flight (London), April 18, 1918

British Output of Aircraft.—Addressing the Bedford Women's Liberal Association on April 11, Mr. Kellaway, Parliamentary Secretary to the Ministry of Munitions, said that the increase for the first two months of the year, compared with the first two months of 1917, was as follows: Airplanes, 223 per cent; aero-engines, 245 per cent.

The average weekly production of airplanes for this year equalled the average production for two months in 1915, while in the case of machine guns, one week's production equalled that of five months in 1915.

Flight (London), April 25, 1918

French Aviators Cross Sahara Desert.—To France again falls another pioneer achievement, the crossing of the Sahara by airplane. So far half of the desert had been conquered, but now, according to the *Echo de Paris* of April 20, the full trip across has been accomplished by three machines, which left Ouargla and arrived at Salah. The trip was completed in seven hours, with a solitary landing at Inifel.

Flight (London), May 9, 1918

America's Air Fleet (Editorial).—It is reasonably certain that those who have criticized the delay in the American program have failed to take account of the fact that America, in common with the other Allied nations which had not made preparation for war their whole aim in times of peace, had to go through a period of organization of production before her aid could become effective.

Armies and air fleets are not created by a stroke of the pen. American industries were still neutral, thirteen months ago, on peaceful industry, and even though some considerable proportion of her factories had been in whole or part engaged in the production of munitions of war for the Allies, it still has to be remembered that it was only a proportion. Great as were the supplies that came to us across the Atlantic before America herself entered the war, they were still but a fraction of the whole needed for the prosecution of the war on the modern scale.

Therefore when at last America decided that she could no longer remain out of the struggle, the first thing to be done was to organize her factories for war. We of our own experience know what it means to take all our essential industries off their legitimate work and to put them on to another class of work which entails a complete recasting of all the systems previously in use.

Apart from every other consideration, time—and a great deal of time—is necessary because it is not enough to partially organize and endeavor to complete the process while engaged on actual production. To attempt that is to invite defeat of the whole effort from the start. It took us a full two years to effect the metamorphosis, though it is true that we labored under the handicap of having to conduct intensive war at the same time, so that for America to have practically completed her war organization within the year is something she is entitled to point to with considerable pride.

It may be that incidental mistakes, involving delay and disappointment in the full program, have been committed. Indeed, we are assured that our American friends were the first to admit that errors have been so committed, but on the other side of the ledger we think they are to be congratulated on having made as few as they have. The main point of the thing is that American help bids fair to come to the Allies in full measure just when it will be of most service to the cause of civilization.

The Aeroplane (London), April 3, 1918

The Bombing of the Goeben.—The Admiralty has issued the following detailed report on the recent bombing of the German-Turkish battle cruiser Goeben in the Dardanelles.

Details now available of the air operations carried out at the Dardanelles against the Goeben and Breslau show that as soon as news that the vessels were out had been received early on Jan. 20 our air patrols were despatched. Twenty minutes later a message was received that Kusu and Kephalo were being shelled, and all the Greek pilots at an adjoining air station at once flew over to take part in the air operations. With the first clear light it was seen that H.M.S. Raglan had sunk at anchor and that monitor 28 was on fire amidships.

The Goeben and Breslau were then about five miles out to sea off Kusu and steering south. They were followed by our planes. Ten minutes later eight to ten machines were continuously harrying the enemy ships. This action of our

aircraft was causing the Breslau to steer a zigzag course, which brought her into one of our minefields, where she struck a mine. Very shortly afterwards she was hit by an aircraft bomb and sank. Five Turkish destroyers endeavored to reach the spot, but were driven off by two British destroyers.

Heading for the Dardanelles the Goeben struck one of our mines, and developed a list to port. Aircraft continued to bomb her while she entered the straits, and she ran aground at Nagara Burnu. Pilots who undertook a special reconnaissance reported that she looked as though aground, as she was slightly tilted up forward and a large amount of disturbed mud was seen around her. Sixty-five flights were made during the day, and a great many pilots and observers made two or three attacks on the enemy's ships.

At dawn on the following day a raid was made on the Goeben by five bombers. It began in semi-darkness and the Narrows were obscured by clouds, so that the ten heavy bombs were dropped during anti-aircraft fire in the estimated position of the Goeben and no observation could be made. At midday a bombing raid commenced in which fourteen machines took part, going up at intervals of ten minutes.

Shortly after 6 p. m. on the 21st nine machines made a night raid. Continuous anti aircraft fire was directed on them from shore batteries and from the Goeben. Six heavy bombs were dropped on the Goeben from heights of 2500 ft. to 3000 ft. While no claim to a direct hit can be made, one explosion took place in close proximity to the two searchlights of the Goeben, which seemed to be the reason for their immediate extinction. All the machines returned safely. Fifty-one flights were made during the 24 hours, and two tons of bombs were dropped.

At 9 a. m. on the 22nd four machines made a successful raid. One made a direct hit amidships, and a volume of steam and smoke appeared directly afterwards from the ship. R N A S machines at 1 45 p. m. dropped eight bombs, which fell close to the Goeben.

In a night raid three small seaplanes all dropped bombs on her. One of these pilots dropped his bombs on or near the ship from the height of 4000 ft. On the return flight he landed midway between Lemnos and Imbros owing to engine trouble, and on his gliding to the surface six shots were fired at his machine, apparently by a submarine, when he was at a height of 600 ft. He was not molested, however, when on the water, and, although Vérey lights were fired from the seaplane and calcium flares dropped, he received no assistance during the night of the 22nd. At 5.30 a. m. on the 23rd a seaplane found and towed his machine to the mouth of Mudros Harbor, where she was brought in undamaged by a destroyer.

At midnight on the 22nd four direct hits were registered on the Goeben, and from 8 a. m. that day to 8 p. m. on the 23rd 48 flights were made, bombs weighing 56½ cwt. being dropped. Forty six flights were carried out in the next 24 hours, and 73 cwt. of bombs were dropped on the Goeben, ships and boats round her, and on the Galata aerodrome. During the following 24 hours the flights numbered 34, and the bombs dropped weighed three tons.

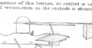
Raids were continued until the 27th, but on Jan. 28 seaplanes reported that the Goeben had disappeared, and that there was no wreckage floating around the spot where she had been. A reconnaissance of the Constantinople area to locate her was made on Jan. 29. The Goeben was seen lying near the inner of the two bridges spanning the Golden Horn by the arsenal, and stretching half way along that bridge. The largest of the arsenal dry docks was seen to be flooded and open, and the smaller dry docks contained a ship which could not be identified.

During the attack, which lasted from Jan. 20 to Jan. 29 276 flights were made by our aircraft, and approximately 15 tons 3 cwt. of bombs were dropped, while at least 16 direct hits on the Goeben were recorded.

The Aeronautic World (Tokyo), April, 1918

The Ogawa Arrow Biplane.—The Ogawa Arrow Biplane, which is shown in plan, front and side elevation in the accompanying drawings, may be looked upon as a Japanese development of the inherently stable Dunne machine.

Like the latter, the Ogawa biplane purposes to achieve inherent stability through an exaggerated sweepback, which really takes the form of an arrow. This setting of wings is known to endow an airplane with so much inherent stability that the machine actually becomes uncapsizable, although, in direct consequence of this feature, its control is very sluggish. This lack of sensitiveness on the controls is obviously a draw-



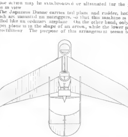
Side Elevation

back, particularly in landing, where quick response to the controls is a much greater asset than absolutely inherent stability. Sluggishness on the controls is further accentuated in the Dunne type by the absence of tail planes, longitudinal, lateral, and transverse control being all achieved by the wing flaps,

Front Elevation

whose action may be synchronized or alternated for the purpose in view.

The Japanese Dunne carries tail plane and rudder, both of which are mounted on outriggers, so that this machine is controlled like an ordinary airplane. On the other hand, only the upper plane is in the shape of an arrow, while the lower plane is rectilinear. The purpose of this arrangement seems to be



Plan

the combining of an inherently stable arrow plane, which is not aerodynamically very efficient, with a plane of good lift/drag characteristics which does not embody inherent stability to any extent, as far as may be judged from the accompanying drawings.

Whatever the merit of this combination, it is at least interesting to note that after having mainly produced copies of foreign machines, Japanese airplane constructors are now beginning to develop personal conceptions in this matter. The evolution of Japanese aviation on original lines will be worth close attention, the more so as the Japanese are past masters in light wood construction, and also in view of the fact that several large industrial concerns have recently undertaken the construction of aero-engines. Among the latter may be mentioned the powerful Mitsubishi shipbuilding yards of Kobe.

News of the Fortnight

Inauguration of the Air Mail

The inauguration of the regular air mail service between Washington, D. C., and New York took place, as scheduled, on May 15.

Although no formal ceremonies attended the inauguration of the service, there was a large gathering of officials at both terminals. Among those present at the Washington terminal were the President and Mrs. Wilson, Postmaster General Burleson, Secretary of the Navy Daniels, Assistant Secretary Roosevelt, Major Gen. W. L. Kenly, Director of Military Aeronautics, and representatives of the Aircraft Board, the National Advisory Committee for Aeronautics and the Senate and House Committees on Post Offices and Post Roads.

The machines used for this service were Curtiss biplanes fitted with 150 hp. Hispano Suiza engines.

Since then the air mail has functioned with a sufficient regularity for so novel an undertaking to hold out favorable prospects for such additional air lines as may be organized in the future.

Two postal airplanes of a more powerful type, fitted with Liberty engines, have since been placed in service, and one of these machines flew on May 23 that day from Philadelphia to New York in 52 min., beating the best previous time by 23 min.

"The success obtained in operating the airplane mail service," said Postmaster General Burleson on May 29, "exceeds what I expected of the new route during its initial stages. The army has rendered a splendid service, which is not only a distinct contribution to the commercial world, but is proving valuable training for the aviators who are about to enter upon a greater task in France."

Billion and Quarter for Aeronautics

Nearly a billion and a quarter dollars for aeronautics is carried in the Army and Navy appropriation bills for the fiscal year ending June 30, 1919, which is now before Congress.

The Army appropriation bill provides $990,250,812.77 for the Signal Corps, including its now divorced Aviation Section. The report accompanying the bill shows that on May 16, 1918, the Signal Corps, including the Air Service, was made up of 13,343 officers and 121,746 enlisted men.

The Aviation Section of the Signal Corps, according to the testimony before Congress, is as follows: Number of officers, 12,107; number of enlisted men, 136,761; number of fliers, 4,054; number of machines in France, 1,316; number of machines in the United States, 3,760; number of combat machines in France, 323, and the number of aviation training camps in the United States, 27. It is reported to the committee that enlistments in the Aviation Section of the Signal Corps had become so rapid that the department had to put a stop order on the same. While it has been generally rumored that we had no airplanes with our forces in France the fact is there are 1,316, of which 323 are combat or fighting machines.

In the naval bill $220,383,119 is carried for aeronautics, as passed by the Senate, while the original appropriation, as passed by the House, was $188,042,960. An appropriation of $100,000 is made for improvements to the naval air station at Pensacola, Fla., and the House appropriation of $150,000 is increased by the Senate to $200,000, for the acquirement of the remainder of Parris Island, Port Royal, S. C.

Air Service Association Is Formed

The increasing importance of the Air Services as an arm of reconnaissance and offense, and the growth of independent professional ideals and theories among the flying officers have just been given expression in an organization known as the Air Service Association.

The purpose of this Association, as appears from its provisional constitution, is to unify all branches of the Air Service, to promote *esprit de corps*, to act as a clearing-house for ideas on mechanical improvements, method of training and aerial tactics, and to control a publication for the dissemination of news and information of benefit to the service.

The Association has been approved by Major-Gen. William L. Kenly, Director of Military Aeronautics.

The Association came into being as follows: On the evening of April 2, the officer commanding at Gerstner Field, Major M. Kirby, A. S. S. C., presided at a meeting of flying officers, who unanimously approved the suggestion put forth of forming a service association of their own along lines of similar Army and Navy organizations, and to be made up of the commissioned personnel of the Air Services.

Temporary officers were nominated and elected, and a committee appointed to draft a constitution and by laws. This was followed on April 5 by the adoption of a temporary constitution and by-laws.

Communications have been addressed by the secretary to officers of the Army and Navy Air Services abroad, and to commanding officers of flying fields and air stations throughout the country, requesting them to bring the Association to the attention of all flying officers. The replies received indicate that officers are enthusiastically responding to the invitation to join the Association.

In July the election of permanent officers and the Board of Governors will take place, and the constitution and by-laws will be submitted to the first annual meeting for ratification or change as desired by the members.

The Air Service Association is a non-political organization, and is organized solely in the interests of the Air Services as a *whole*. Its tenets, beliefs and opinions will be expressed in the Air Service Journal, which has been selected as the official journal of the Association, which will also publish such articles by members of the Association as are approved by an editorial staff to be appointed by the Board of Governors from the regular and honorary membership.

The initiation fee is ten dollars, and includes a year's subscription to the official journal of the Association. No dues will be collected.

Officers of the Army and Navy Air Services should send their applications for membership and initiation fee direct to Capt. William J. Malone, A. S. S. R. C., Secretary, A. S. A., Gerstner Field, Lake Charles, La.

Naval Aviators Wanted

The Naval Reserve Flying Corps has again been opened for applications to civilians and members of some branches of the Naval Reserve. It has been generally understood that applications from civilians would not be received, but an additional opportunity is now given to them. Applications should be addressed to Capt. Noble E. Irwin, Supervisor, Naval Reserve Flying Corps, Navy Department, Washington, D. C.

Marine Corps Enlists Aviators

A big drive is now on in recruiting men for the Aviation Section of the Marine Corps. Special efforts are being made to enlist college men and clean-cut, aggressive, quick-thinking and fearless athletes. Applicants who may have failed in regular Army and Navy Aviation will be considered.

For this purpose a personal campaign among the colleges of the country is being conducted by representatives of this Corps. They consist of privates and officers, all of whom are college men themselves. The results are very satisfactory.

Student aviators will be enlisted as gunnery sergeants and sent to the Massachusetts Institute of Technology, Cambridge, for ground work. The course there covers ten weeks. Thence they will be sent to Parris Island or some other station for training in flying. The time for this instruction has been reduced to eight weeks.

Signal Corps Wants News Photographers

A number of high-grade news photographers are urgently needed by the Signal Corps. These men must have expert experience in the handling of speed cameras such as Graflex and Graphic, and also understand speeds of lenses and various makes of cameras and operation of same.

Only those men who can furnish reference as to their actual experience as news photographers will receive consideration.

The men selected for this branch of the service will be sent to a school for military training. Upon completion of the training they will be promoted to grades of Sergeant, First Class, and will be ordered overseas in a short time.

Applicants must be citizens of the United States between the ages of 21 and 31. All communications should be addressed to Air Division, Training Branch, Photographic Section, Signal Corps, Washington, D. C.

To Protect Inventors

A bill creating a war inventions board to assist American inventors in developing devices which would be of value to the Army or Navy in winning the war is being drawn up by the American Inventors' Association of Washington, D C, and probably will be introduced in Congress in the near future

"The association will exert all of its energies to secure the passage of legislation creating a war inventions board to consist of five members, whose duty it shall be to seek, receive, inquire into and assist in the development of inventions of possible military value, the said board to be non-partisan and to be compensated by and under the Government," reads a statement approved at a meeting of the association on May 9

F J Hemen, president of the association, said the bill probably will provide that this board shall protect the patent rights of devices laid before it, so that it will not be necessary to file the plans as public property in the Patent Office

Wright-Martin Buys G. V. C. Plant

The Wright-Martin Aircraft Corp has bought for more than $1,000,000 the General Vehicle Co's plant in Long Island City, according to press reports The property consists of a six-story and a two-story building and other smaller structures in a plot bounded by Starr and Borden avenues and Fox and Beaver streets It has a connection with the Long Island Railroad It is said that the aircraft corporation has a contract to make for the Government 3,000 motors of 300 horsepower each, which it will manufacture in its new factory Between 500 and 600 men are employed in it now, and the corporation intends to increase its force of mechanics and apprentices until it is 8,000 men, the capacity of the plant The work of building the motors will be rushed in order to have them ready for the Government's airplane program

Alexandria Aircraft Corp. Formed

Capt A W Briggs and J J Rooney have resigned as general manager and chief engineer, respectively, of the Briggs Aeroplane Co, Alexandria, Va

The business style of the company has been changed to the Alexandria Aircraft Corp Blaine Elkins continues as president, and John W Fenton, Jr, as secretary and treasurer W L Bonney, who was purchasing agent, succeeds Captain Briggs as general manager Webb C Artz is business manager The reorganization took effect on May 15 The factory of the new company remains in the old Portner brewery building, Alexandria.

On the same date the Briggs Aeroplane Co, of which Capt A W Briggs is the head, was incorporated under the laws of the State of Virginia The company has leased the Pioneer Mills property in Alexandria To our Washington representative Captain Briggs stated on May 13 that this company plans to have its first machine ready for flight in about five weeks

U S to Test Gasoline Substitute

Government tests of a gasoline substitute, which the inventor, Dr Louis Clement says can be manufactured for 8 cents a gallon, will be made in a few days at Pittsburgh Gasoline substitutes presented for tests to date have fallen short of claims made by inventors, and Government experts have become skeptical that a powerful explosive gas can be made more cheaply than the gasoline refined from oil

Fire Protection for War Plants

To minimize the possibilities of fires in munitions plants and all factories engaged on war work, the War Industries Board on April 9 created a fire protection section, which will maintain a close inspection of all plants engaged on Government work

It will be assisted by the intelligence bureaus of the Army and Navy, and all local and district fire inspection services in the country Where circumstances warrant, it will also enlist the aid of the fire marshals of the various States, and ask the cooperation of insurance underwriters.

Marines Can't Become J. M. A.'s

Following is a digest of a recent decision of the Judge Advocate General

A member of the Marine Corps detached for service with the Army is not, under the national defense act, eligible for detail in or attachment to the Aviation Section of the Signal Corps, and therefore cannot receive the rating of junior military aviator

Newspaper Correspondent Reports on Production

David Lawrence, a Washington correspondent for the New York *Evening Post*, has recently made a survey of the production of some of the aircraft and engine factories Among other places that he visited were Dayton, Detroit, Buffalo and Elizabeth

At Elizabeth, Mr Lawrence was received by Harry Bowers Mingle, president of the Standard Aircraft Corp and the Standard Aero Corp who is known to carefully guard as secret the important work that his plant is doing for the Government Mr Lawrence evidently did not obtain the basis for as good a "story" as he anticipated and "a feeling of disappointment" is reflected in his article that was published

In this connection, Mr Mingle has written the following letter to AVIATION AND AERONAUTICAL ENGINEERING which fully explains his position in the matter

"We have noted the article in the New York *Evening Post* of May 23rd relative to the work being done at the Standard Airplane plant. The writer had a personal conference with Mr Lawrence and stated to him that in our opinion the work which we are doing here is of a confidential nature, and that to date the production of both the Standard Aircraft Corporation and the Standard Aero Corporation has been satisfactory to the Government

We have no apologies or explanations to make for the progress of our work and it is our belief that the results which this plant have attained in production and in development speak for themselves and that no statement other than this is advisable from a Government standpoint

Aviation Fatalities Not High

The Secretary of War has authorized the following statement The records of the Department show that from the beginning of training in June 1917 to date the fatalities at military aviation fields in this country have been 51, viz. 10 officers and 29 cadets killed in training flights, and 12 men killed in unauthorized flights and ground accidents

Since the training of aviators began in this country our student aviators have flown a total distance of considerably more than 100 000 miles Considering the large number of men in training and the number of miles flown the fatalities have been remarkably low

Taking into account the ordinary hazards of this occupation, the development of a comparatively new art, and the ratio of accidents in the everyday fields of endeavor, the fatality record among America's student aviators will compare favorably with those of other countries

H. W. Johns-Manville Co. Branch to Move

The Houston, Tex, office of the H W Johns-Manville Co, will be located at 424 to 426 Washington Avenue, on and after July 1, 1918

Glenn L. Martin Opens New Plant

The Glenn L Martin Co held a reception on May 29, the occasion being the opening of its new plant on St Clair Ave., Cleveland, Ohio Joseph A Steinmetz, president of the Aero Club of Pennsylvania, addressed the invited guests.

Seaplane Emergency Ration

An emergency ration, consisting of one pound of brown bread, one pound of baked beans and one quart of water, for use on seaplanes, has been adopted by the Navy Department.

Whitman & Barnes Sales Changes

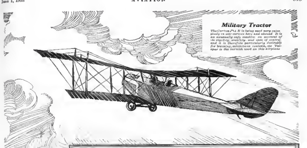
The following changes have been made in official positions in the Whitman & Barnes Mfg Co's sales department

A B Hall, vice president of the Whitman & Barnes Mfg Co., will have supervision of the company's sales He has for twenty years been connected with the company in various official capacities His early connections were with the company's Chicago sales office as manager, which position he held until his transfer to the general office at Akron

R S Carter, district representative of the company, with headquarters at Pittsburgh, has been promoted to sales manager and will have direction of twist drill and reamer sales from the Akron general office

H E Fisher, formerly with the Pittsburgh Model Engine Co, Pittsburgh, Pa, has become associated with the Whitman & Barnes Mfg Co, Akron, Ohio He succeeds R S. Carter as mechanical engineer and will have charge of sales in the Pittsburgh district

Paul E Thomas of Chicago, for years in the railroad circles in the traffic department of the Seaboard Air Lines has become connected with the Whitman & Barnes Mfg Co, Akron.



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The Curtiss JN4 B is being used very extensively in war-service here and abroad It is an unusually safe machine on account of its rigidity, stability, and ease of control and it is therefore particularly desirable for training, exhibitions contests, etc Valspar is the varnish used on this airplane

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The organizers and members are all commissioned officers of the air services.

The Association has been endorsed and approved by Major-General Wm. L. Kenly, Director of Military Aeronautics, and by prominent Naval Aviation officers.

The initiation fee is ten dollars, including one year's subscription to the AIR SERVICE JOURNAL, the official publication of the A. S. A. There are no dues.

Send your application and initiation fee to Capt. Wm. J. Malone, Secretary, A. S. A., Gerstner Field, Lake Charles, La.

AIR SERVICE ASSOCIATION

Application for Membership

1918

Capt. Wm. J. Malone, A. S. S. R. C.,
Secretary Air Service Association
Gerstner Field, Lake Charles, La.

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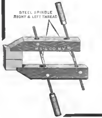

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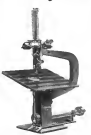

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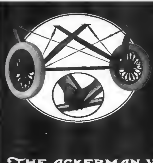

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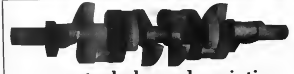

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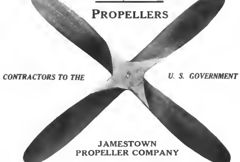

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See Index to Advertisers on page 638

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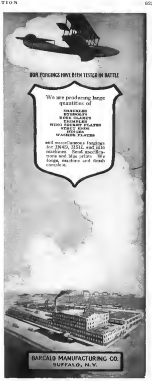

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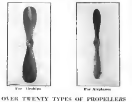
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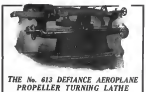

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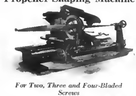

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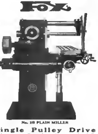

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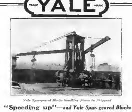

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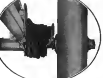

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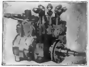

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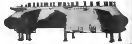

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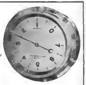

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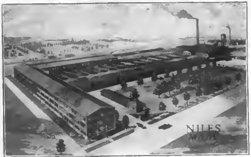

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